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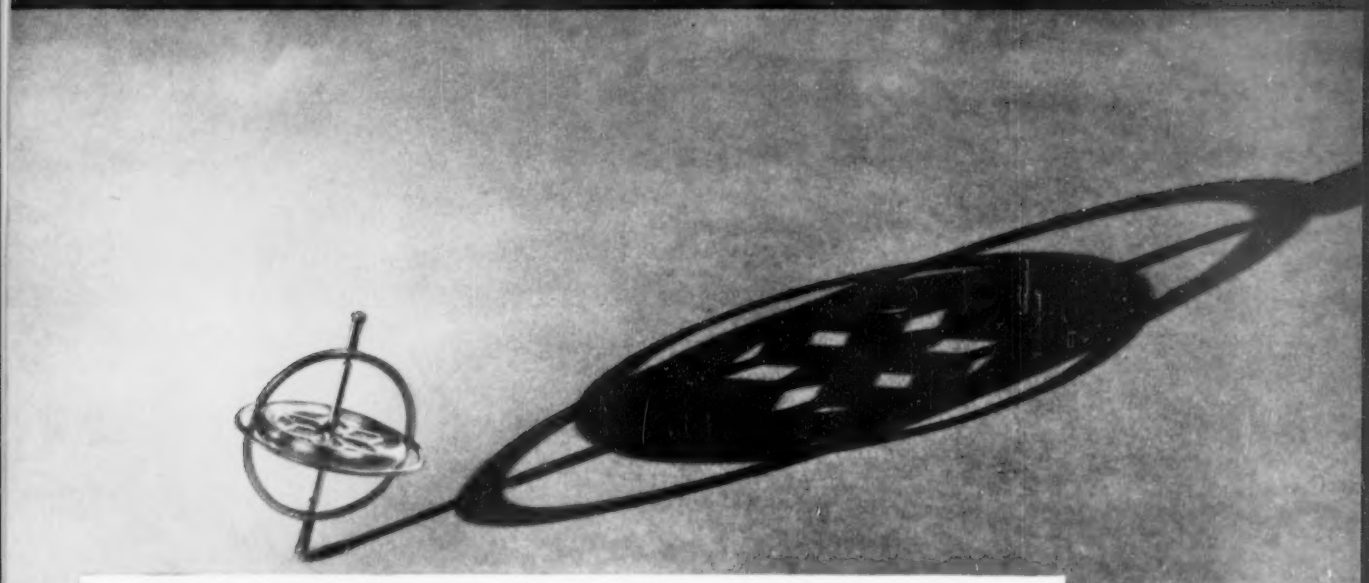

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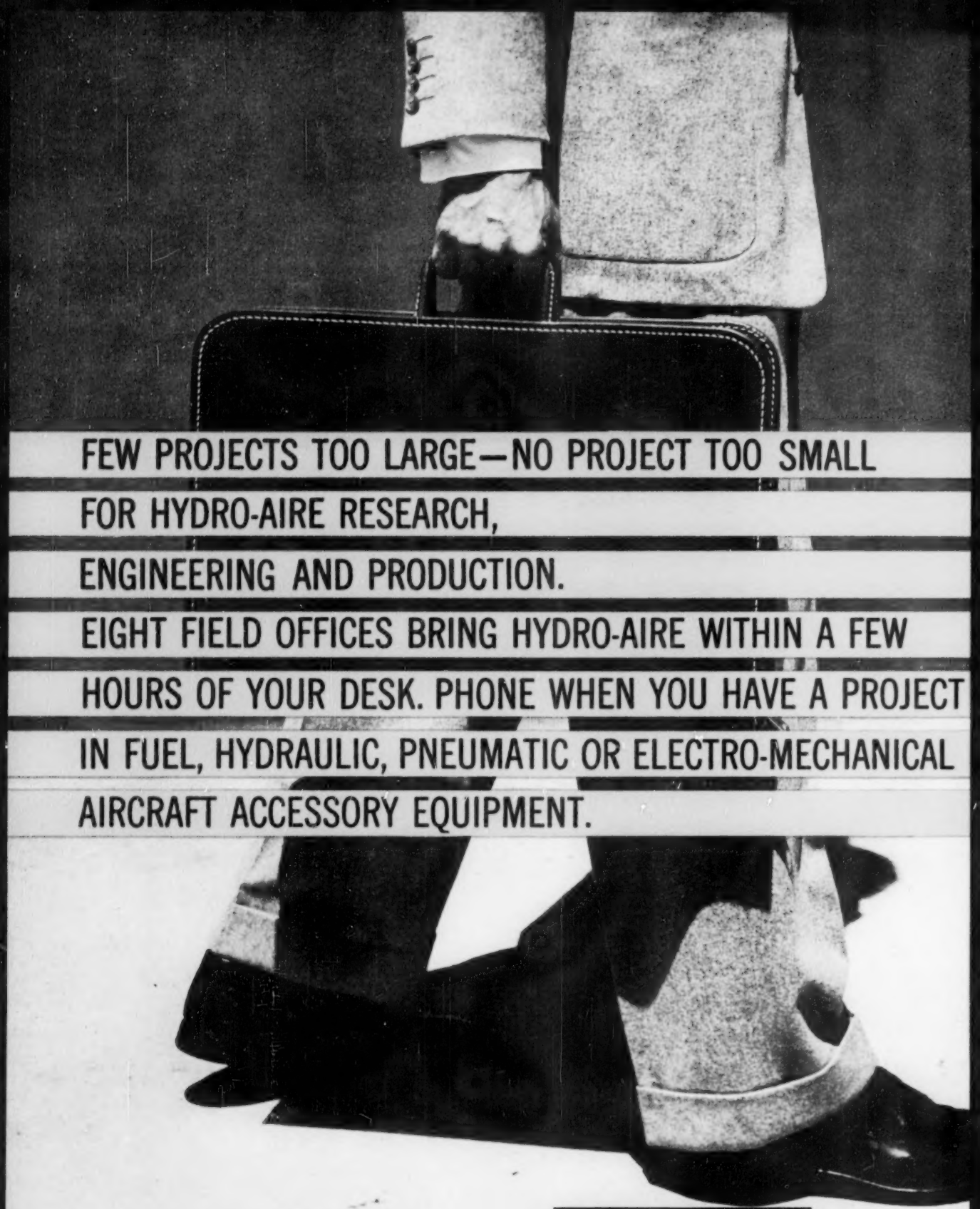

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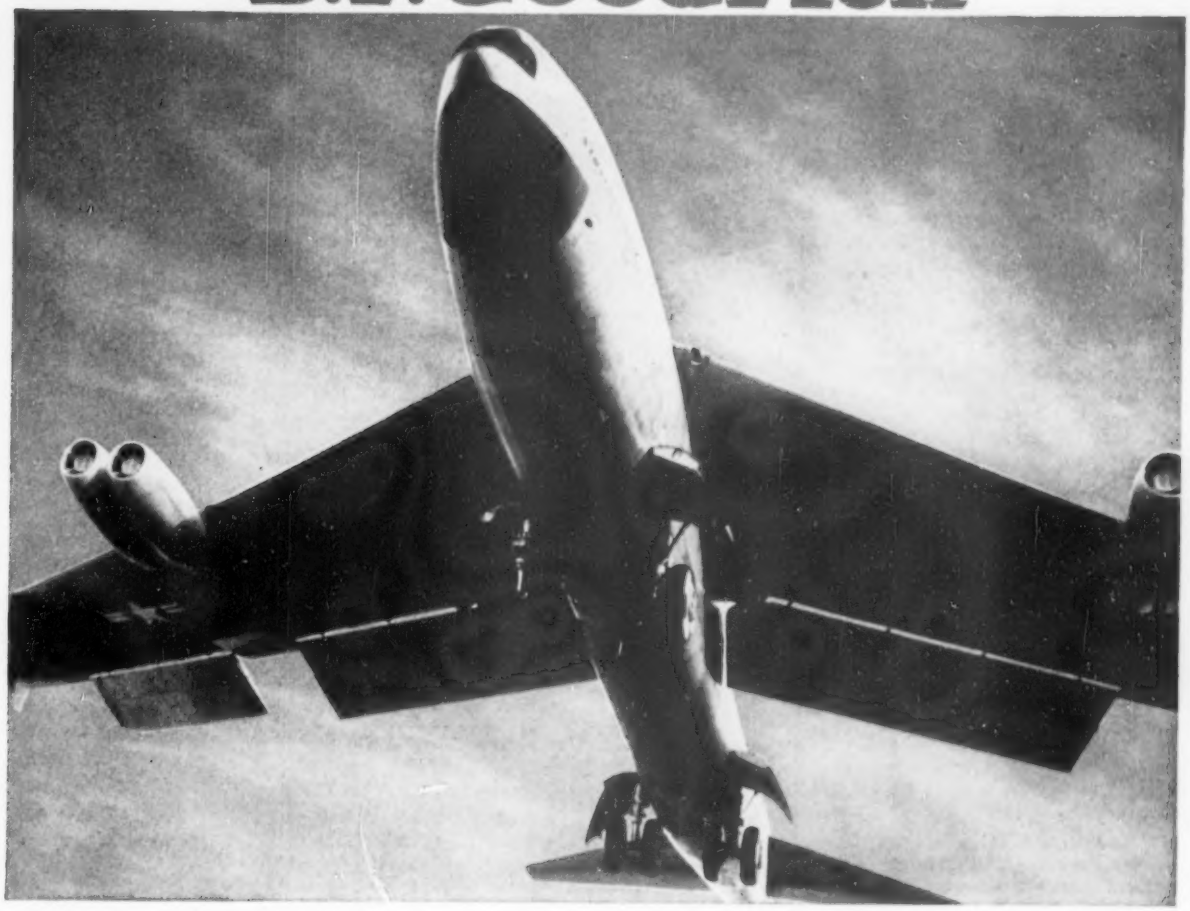

B. F. Goodrich brakes cut weight to stop faster airplanes

AIRPLANE BRAKES have a tougher job to stop today's faster-landing airplanes than they did even five years ago! They have to give this improved performance and still be made lighter to allow for increased pay loads—whether it's bombs, people or cargo. Here's how B. F. Goodrich brakes have kept their weight in trim, improved braking efficiency for faster-landing B-52's, the Boeing jet shown above.

The B. F. Goodrich expander tube principle has the basic advantage that braking action applies *equal* pressure over the full circle of the drum, giving greater braking power, better load distribution. Today's B. F. Goodrich brake has a new, narrow-cavity tube that gives even more braking pressure, with *less* fluid.

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Volume 58 June 1, 1953 Number 22

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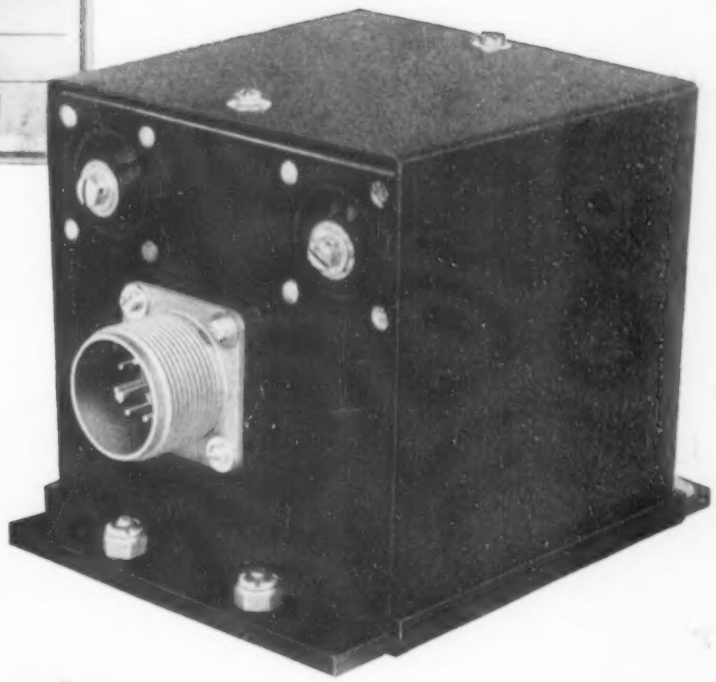

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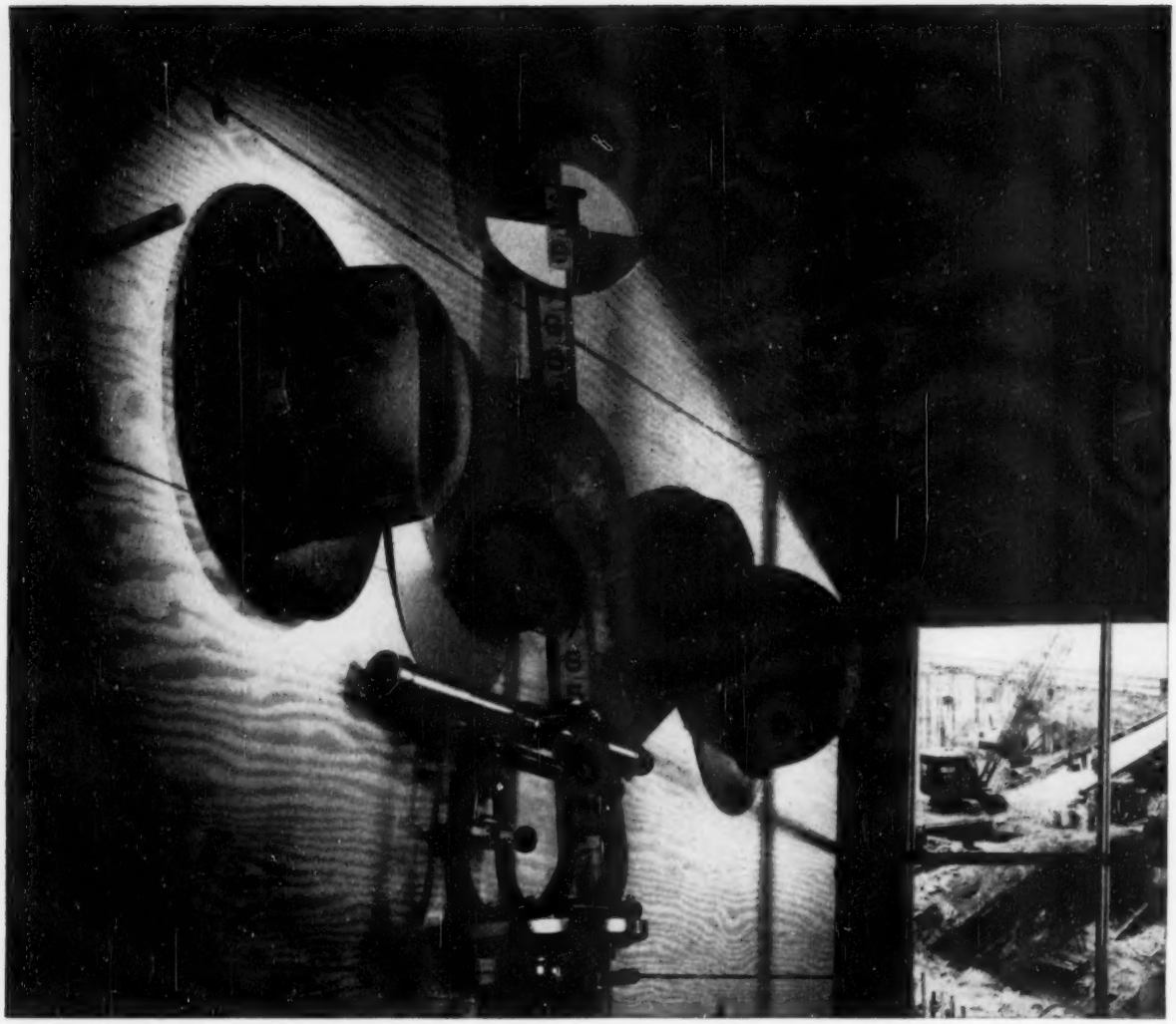

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NEWS DIGEST

Domestic

Nonsked DC-3 cargo transport with one engine crippled crashed last week while trying to land in heavy fog at Lambert Field, St. Louis, killing four pilots, a stewardess and a mechanic. Airport officials say the Meteor Air Transport Co. plane may have run out of gas after it made one pass at the field and was turning for a second try.

Public hearings on Kaiser-Frazer Corp.'s contract for production of Fairchild C-119s at its Willow Run, Mich., plant are scheduled to open June 2 before a Senate Armed Services Subcommittee headed by Sen. Styles Bridges.

Captain and co-pilot of a Resort Airlines' C-46 were killed when the passenger transport crashed and burned May 22 in an electrical and wind storm 16 mi. east of Des Moines. The airliner was on a Chicago-Cheyenne, Wyo., ferry flight.

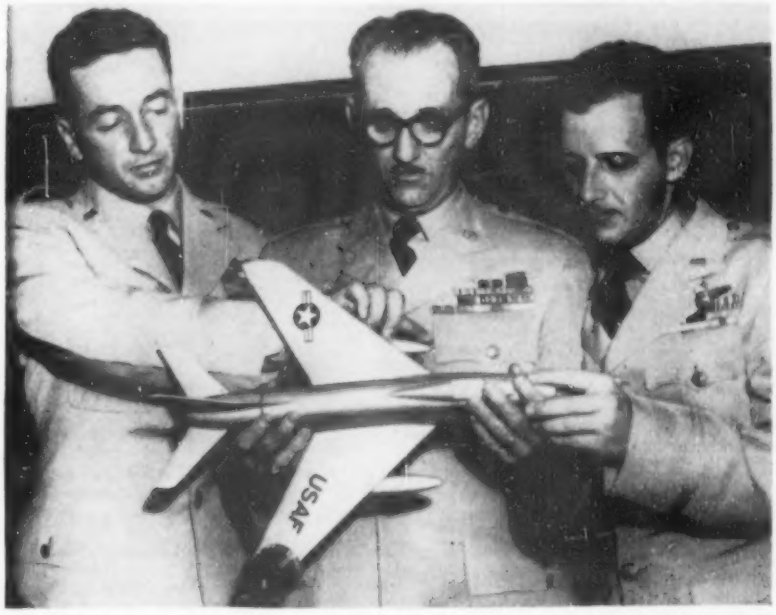
Smokeless Rato (rocket assisted takeoff) has been developed, is in full production and first deliveries have been made to Navy and Air Force squadrons, Navy Bureau of Aeronautics announces.

Electronic simulator for the C-124A Globemaster (AVIATION WEEK May 4, p. 77) has been accepted by USAF from Curtiss-Wright Corp.'s Electronics Division, company sources say. Contract for four units involves several million dollars.

Ralph G. Platt, aviation editor of the Cleveland News, was re-elected president of the Aviation Writers Assn. at the 15th annual convention in Ft. Worth and Dallas. Other re-elected officers: Niels C. Beck, dean of Parks College, East St. Louis, Ill., secretary, and Leslie V. Spencer, vice president, Albert Woodley Co., treasurer. Leroy Whitman, editor of the Army, Navy and Air Force Journal, was named first vice president; Mrs. Holland Page, editor of Cross Country News, Austin, Tex., second vice president, and George F. McLaughlin, Jamaica, N. Y., historian.

Military Air Transport Service celebrates its fifth anniversary today (June 1).

CAB hearing has uncovered no definite clues to the crash of a Western Air Lines DC-6B in San Francisco Bay Apr. 20. Eight persons were killed, two survived.



HITHERTO SECRET North American XF-100 jet fighter was publicly revealed for the first time when an early model of the plane was used in posing returned USAF jet aces Capt. Joseph McConnell, Jr. (left) and Capt. Manuel J. Fernandez, Jr. (right) at the Pentagon. In the center is the latter's father, Col. Manuel J. Fernandez. The two F-86 aces stated during an interview that they had fought MiG-15s as high as 49,000 ft. Both are slated for instructor posts in this country. McConnell is credited with 16 MiGs and Fernandez with 14½. The first view of the new USAF XF-100 shows the craft's large wings with 45-deg. sweep compared with F-86's 35 deg. Horizontal tail is also placed lower than on the F-86. The XF-100 is designed to take a P&WA J57.

Guided missile ground control development, design and manufacture is being set up by Westinghouse Electric Corp. at Baltimore as a new engineering section of its Electronics Division.

ZP2N blimp, described as the largest non-rigid airship ever built, has been launched and test flown at Akron, Ohio, by Goodyear Aircraft Corp. It is the second ZP2N "Nan" type constructed for the Navy.

Forty-two lightplanes (6,000 lb. or less) valued at a total of $333,775 were exported from the U.S. in April, boosting foreign shipments so far this year to 132 planes assessed at $1,077,448, Aircraft Industries Assn. reports.

Pratt & Whitney Aircraft reports deliveries of J57 turbojet engines were started during the first quarter of this year.

Financial

Northwest Orient Airlines operating profit for April totaled $115,993, compared with a $373,952 loss during the same month last year. Operating revenues were $5,083,888; expenses amounted to $4,927,894.

International

CF-104 delta-wing jet fighter—designed by A. V. Roe (Canada) for a range of more than 1,500 mi. and speeds up to 1,200 mph.—has been approved by the Canadian government for 1960 production, according to unconfirmed reports.

KLM Royal Dutch Airlines' Convair-Liner crashed during an aborted takeoff from Schiphol Airport at Amsterdam last week, killing a woman and child standing in a road near the field. Sixteen of 34 persons aboard the plane were injured.

Grumman S2F-3s, McDonnell F2H-3 Banshees and British Fairey Gannetts are being considered by Canada for its new aircraft carrier HMCS Bonaventure, under construction as a replacement for HMCS Magnificent. Approximately 120 planes will be bought for the carrier at a cost estimated at $50 million.

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The Aviation Week

June 1, 1953

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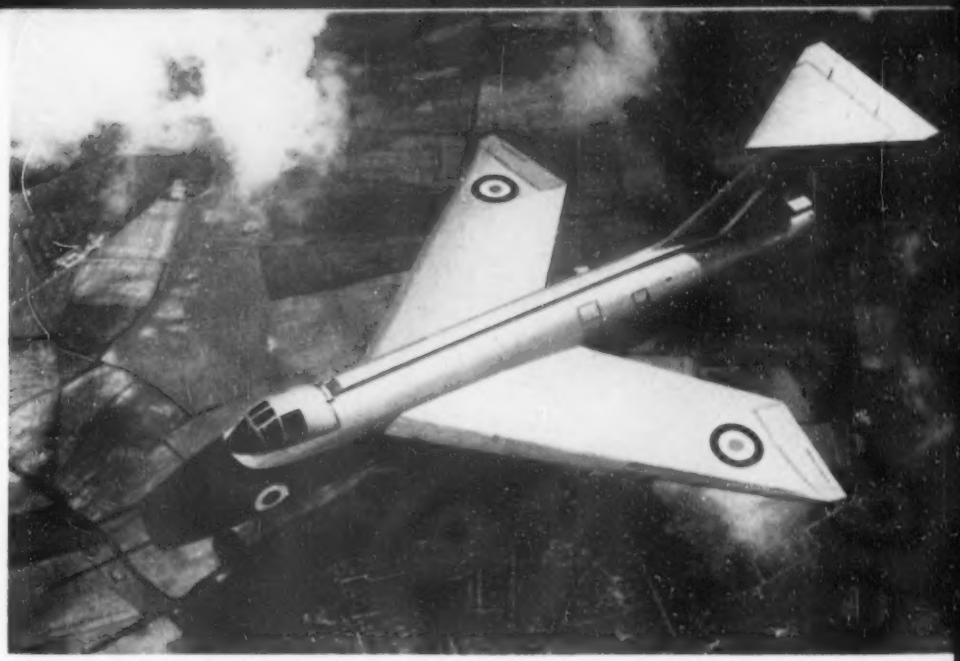
Aircraft At Work Here and Abroad

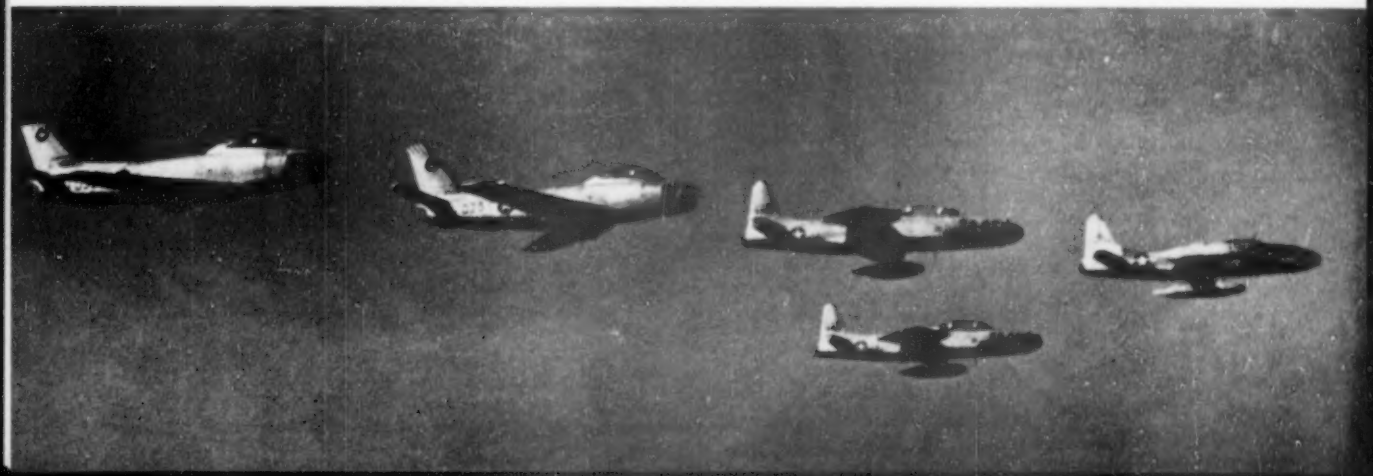


CHANGEABLE SHAPE—Novel-looking Rolls-Royce Derwent-powered Short S.B.5 (above) is being used to test effects of various degrees of wing sweep and different placements of its horizontal tail. Plane thus far has been flown with wings swept at 50 deg. Tail can also be located below the rear part of the long fuselage.

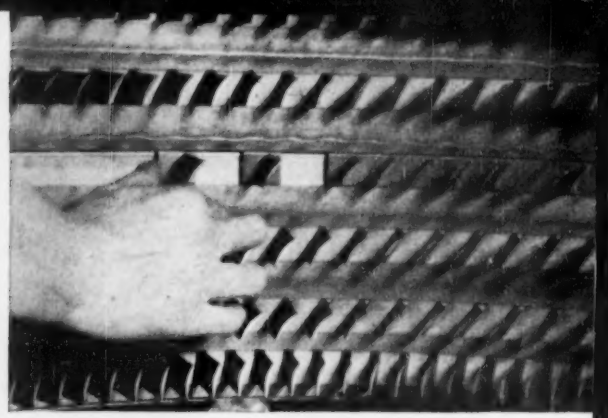
MUSTANG FOR MACH TESTS—Special North American ETF-51D was modified for highspeed tests up to Mach .75. Note new vertical tail, 17 in. taller than usual. Wing structure was also beefed up.

FREIGHTER WITH NEW NOSE—Bristol Freighter Mk. 32 has extended nose and new tail. Six of them have been ordered by British operator Silver City Airways for cross-channel passenger and cargo service.

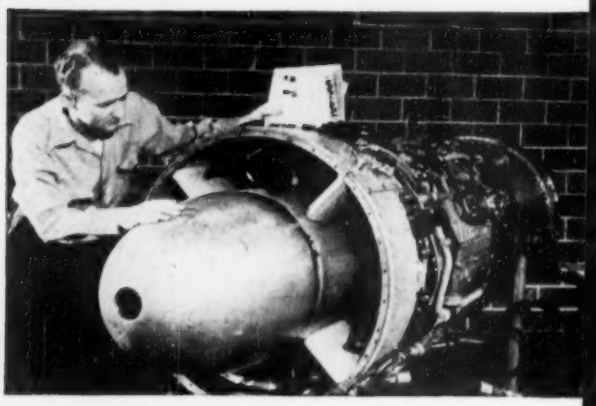
DRONE DETAIL—Five jet planes pictured below are a complete drone flight element used by USAF during atomic cloud samplings at Atomic Energy Commission's Nevada Proving Grounds. At far right is Lockheed QF-80 drone which penetrates the clouds carrying mice and monkeys. Directly astern are its two Lockheed DT-33 guidance planes. Behind fly a pair of North American F-86 chase planes in case the QF-80 suffers a dangerous malfunction.



POWERFUL USAF FIGHTER, the North American F-86 has compiled an imposing record. New engine improvements give Sabre Jet greater speed, more range.



FABRICATED STATOR BLADES are inserted into compressor casing. This development reduces cost with no efficiency-loss.



J47 "HOT NOSE" is warmed by air bled from compressor. Retractable screens help eliminate icing problems.

CONTINUING DEVELOPMENT ON G-E J47 HELPS IMPROVE SABRE JET PERFORMANCE

North American F-86 Flys Faster, Farther

EVER-CHANGING NEEDS of air combat have been met by important refinements and improved performance in the General Electric J47 turbojet—powerplant of the North American F-86 Sabre Jet. A glance at the MIG-alley scoreboard attests to the F-86's past success; but now even better J47 engines are powering improved Sabre Jets in combat against the MIG.

MORE SPEED . . . MORE RANGE were necessary to keep the Sabre Jet's present superiority intact. So G-E engineers designed more efficient compressors, water/alcohol injection, and a total of 3000 design improvements. Result? Greater thrust, lower specific fuel consumption at higher rpm—with *no increase* in engine frame size or weight.

CONTINUING IMPROVEMENTS have made the J47 America's number one production turbojet. Yet no G-E engine design is static. Even now, General Electric's vast jet engine facilities are using every means possible to make G-E jets more powerful, more reliable, and more economical than currently-produced engines. Progress is General Electric's most important product. *General Electric Co., Schenectady, N. Y.*

210-14

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WHO'S WHERE

In the Front Office

Richard B. Clevering, former Washington manager for Allison Division, General Motors Corp., is new president of Harvill Corp., Los Angeles.

James W. Mariner has been named vice president-sales of Northwest Airlines. Also promoted: **C. L. Stewart**, assistant vice president-planning; **W. J. Eiden**, assistant vice president-budgets; **Dale Merrick**, assistant vice president-properties, and **Frank J. Scott**, assistant secretary.

R. F. Baird has been appointed vice president and general manager of Aircraft Metal Forming Co., Burbank, Calif. **Seibly S. Buffum** is new sales manager.

Harold Crary will retire July 1 as United Air Lines vice president-sales but will continue to serve the carrier as a consultant.

Martin DeBear has been named vice president-sales of Airponents, Inc., Hasbrouck Heights, N. J.

Changes

Vice Adm. H. B. Sallada (USN Ret.) has been appointed assistant general manager of Chance Vought Aircraft Division, United Aircraft Corp., Dallas. **Clifford E. Burt** is new factory manager, replacing **Bertram D. Taliaferro**, who has retired.

Harold W. Pope has been elected an associate and director of guided missile and aero-mechanical activities of Sanders Associates, Inc., Nashua, N. H.

Delos Thurber has been promoted to general operations manager of Philippine Air Lines, succeeding **Walter L. Hurd, Jr.**, who resigned to return to duties as a pilot.

Joseph Milton is new general manager of Propeller Service of Miami, Inc., succeeding **Martin Levy**, former president who sold out his interest in the corporation.

Edwin A. Koch has been named comptroller of California Central Airlines.

Albert E. Smyser, Jr., has joined North American Aviation, Inc., as eastern public relations representative in New York for the Los Angeles corporation.

J. H. Devins has been appointed manager of public information for Sperry Gyroscope Co., Great Neck, N. Y.

Verle J. Flieger has been promoted to industrial relations manager at Pacific Airmotive Corp., Chino (Calif.) Division.

Karl Hilding Beij, hydraulics and aeronautic instrument engineer, has retired as acting chief of the Hydraulics Section, National Bureau of Standards.

Frank H. Mattix is new sales development manager of Eastern Air Lines. **George W. Hunter** has been named administrative assistant to the vice president-traffic and sales, replacing **Henry C. Suhrke**, resigned.

Charles F. Sharp has been named sales director of National Airlines.

V. Z. Brink has been appointed assistant general manager of Ford Motor Co.'s Aircraft Engine Division, Chicago.

Jack Sidebottom is new engineering manager of Flight Refueling, Inc., Danbury, Conn.

INDUSTRY OBSERVER

► Recent collision of a Republic F-84 and a Wright Field B-29 over Long Island occurred during experiments with new equipment designed to convert F-84s into parasite fighters on long-range bombers (AVIATION WEEK Mar. 30, p. 11). The new equipment attaches fighters to the bomber's wingtip and would permit aerial refueling operations, according to reports.

► Accidental mixture of liquid oxygen and alcohol during "topping off" operations to insure a full fuel load for the Bell X-2 rocket motors before aerial launching from a B-50 is blamed for the fire that resulted in loss of the research plane and two Bell employes (Aviation Week May 18, p. 9). A second X-2 is nearly finished.

► Recent crackup of a Piasecki H-21 helicopter on the ground at Morton, Pa., was believed due to ground resonance, which built up a rocking condition to a point where both rotors were smashed.

► Vortex generators apparent on the upper wing surfaces of the Boeing B-47B jet bombers at Carswell AFB (Aviation Week May 25, p. 10), are designed to improve the airflow over the wings at high speeds and to make possible higher speeds than those for which the airplanes originally were designed. The generators are tiny metal vanes projecting up about one inch from the surface of the wing, in multiple rows from a point near the wingtip to near the attachment of the inboard nacelles. They have been incorporated in all the Boeing B-47s built at Wichita.

► Production version of the Martin Matador B-61A pilotless bomber features a high wing instead of the mid-wing design on experimental models. Other features on the missiles now rolling off the Martin production line include more height in the vertical tail fin, dihedral in the horizontal tail and a streamlined "bullet" fairing at the intersection of tail surfaces.

► John Thorp, West Coast designer of the all-metal Sky Skooter two-place plane, is polling aviation people to test the market potential of selling a knock-down Sky Skooter kit to trade schools and plane enthusiasts.

► Modification line at the Chance Vought plant is set up to handle the powerplant switches for the F7U-3 Cutlass jet fighter. Originally scheduled to use Westinghouse J46 engines, the Cutlass has been flying with Allison J35s due to delays on delivery schedules for the J46. Now J46s are beginning to come through. After test flights with a composite-powered Cutlass—using one Allison and one Westinghouse—some Cutlasses are now flying with two J46s.

► An auto-rotation landing from nearly 16,000 ft. was accomplished by Bell test pilot Elton J. Smith recently in Bell's XH-15 high-altitude copter when engine surge developed and he had to cut off power. In a high-altitude test, he spiraled down in a 10-minute glide, making what is believed to be the longest auto-rotative descent in rotary-wing history. He then flared out for an easy landing at Bell's heliport near Ft. Worth.

► Rotor-Craft Corp. of Glendale, Calif., has purchased U. S. and foreign patents of Landgraf Helicopter Co., Los Angeles, and now controls basic patent applying to rigid "no droop" rotors. One advantage of the rigid blades in transport helicopters, it is pointed out, would be that passengers could board and disembark in safety while the rotors continued to turn.

► Chance Vought thinks that the returnable feature on Regulus missiles in test and training versions has made possible a large saving. For a 100-hr. flight evaluation of such a missile, if it were not returnable, about 200 would be expended. But the Regulus is cutting the number of missiles needed for such a program to 30. Several missiles have been recovered repeatedly without damage after flights at subsonic and supersonic speeds, because of the tricycle gear and drag parachute with which each of the test and training missiles is equipped. Up to 10 flights have been made with a single Regulus.

Washington Roundup

Williamsburg Fiasco

Aircraft industry leaders who expected to get authentic details of the new aircraft procurement picture from Defense Secretary Charles E. Wilson and Air Force Secretary Harold Talbott at AIA's Williamsburg, Va., meeting were disappointed. Wilson and Talbott gave no details of their new aircraft program and offered only a reassurance that the aircraft industry had nothing "to worry about" for at least 18 months.

Wilson said the future of the aircraft industry beyond that would depend on the outcome of the review of service roles and missions scheduled for this summer by the new Joint Chiefs of Staff. Talbott spoke briefly, had little to say. Roger Lewis, Assistant Air Force Secretary for Procurement, and John Floberg, Assistant Secretary of the Navy for Air, also appeared at the Williamsburg meeting.

Slur on Research

Some industry leaders were disturbed by Wilson's continual reference to acronautical research as "boondoggling" and his implication that much of it wasn't really necessary. The industry feels that Wilson also fumbled badly during a quiz period when the aircraft people pelted him with specific questions on their problems.

Wilson's Future

Feeling is growing in Washington that Wilson probably will become the first political casualty of the Eisenhower Administration. The reason primarily is because of his deteriorating relations with Congress, rather than defense policy.

Senators of both parties are becoming increasingly nettled over Wilson's attitude on Capitol Hill and his evasive answers during Senate hearings. There is growing feeling that both Wilson and Kyes are doing a poor job of explaining their defense policy and are leaving many openings for critical counterattacks. Both seem to resent questioning by either senators or reporters trying to find out what the new policy really means. Wilson's relations with the Pentagon's press corps also are at a low ebb.

Air Power Support

Republican Administration is surprised at the strong public and congressional reaction developing against its proposed cuts in air power. Washington's two most influential daily newspapers supported Eisenhower in the election, now have taken strong stands against Wilson's proposed cuts, and some Republicans in both the House and Senate are publicly opposing any reduction in military air power. Republican congressional leadership will face a tough fight to keep the party in line when the new budget comes up for a vote.

Air Force Position

USAF brass plans no open revolt against the new defense budget and was embarrassed at the statement given to Rep. Sam Yorty by its legislative liaison office contradicting many of Wilson's contentions. The statement was handled at USAF operating level as a routine congressional inquiry and not cleared at the air staff level.

USAF elder statesmen, such as retired Gen. Carl A. Spaatz and retiring Chief of Staff Gen. Hoyt S. Vandenburg, are expected to spearhead opposition to the new defense budget.

No Budget Yet

Actually the new defense budget was whipped through with such speed that USAF and Navy have not yet had time to draft a detailed aircraft procurement program tailored to the new dollar ceilings. Defense Undersecretary Roger Kyes told the Senate Appropriations Committee that helicopters, transports, trainers and liaison planes will take the heaviest cuts.

Strong JCS

Washington observers believe the new Joint Chiefs of Staff will prove to be a strong combination with Gen. Ridgway heading the Army, Adm. Carney as boss of the Navy and Gen. Twining as top man in the Air Force.

Big question mark is the new chairman-designate Adm. Arthur W. Radford, who in 1949 called the USAF B-36 program a "billion-dollar blunder" and urged USAF to buy B-49 jet flying wings at a time when flight tests were proving the aircraft too unstable for a bombing platform.

Radford is a bitter foe of the USAF strategic bombing concept and an ardent advocate of the super-carrier Naval task force for the delivery of atomic attacks. Washington observers are watching to see how many of Radford's former attitudes will appear in the service roles and missions review he will conduct this summer.

B-36 Improvements

Details are a legitimate military secret, but B-36 performance has improved considerably since the 1949 investigation. Addition of several items of equipment and new combat techniques have combined to keep the B-36 an effective weapon and give it a useful combat life of at least several more years before the type is phased into use as an aerial tanker to refuel jet bombers. Convair now has built about 300 B-36s and USAF feels the program was a sound investment.

Nike Nonsense

Army is keeping performance details of its Nike anti-aircraft missile under security wraps, but Pentagon observers believe this is mainly to keep the American people from knowing how little this missile offers for defense against enemy atomic bomb attacks.

Army is spending millions to buy and equip Nike launching sites around key U.S. cities, but the Nike does not have sufficient range to reach enemy bombers before they deliver an attack with guided bombs having World War II range. Nike's range is marginal even against conventional high-altitude bombers dropping conventional high-explosive bombs. Technical observers regard Nike as a step forward toward an effective anti-aircraft missile, but still far short of a missile ready for effective tactical operations.

—Washington staff

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Air Power Future Awaits JCS Meeting

- **Key West-type conference will review defense picture, assign roles and missions, study plans and weapons.**
- **Actual aircraft procurement spending during fiscal 1954 appears headed for same level as fiscal 1953.**

By Robert Hotz

Future level of U. S. military air power will be determined by a review of the entire defense picture to be conducted by the new Joint Chiefs of Staff during the summer and early fall.

This study will include a Key West conference-type of assignment of service roles and missions plus an intensive and detailed study of strategic plans, new weapons, mobilization requirements and defense production levels. From it will evolve the fiscal 1955 Defense Department budget and the trend of U. S. military effort for the next three years.

Adm. Arthur W. Radford has been nominated Chairman of the JCS. Other nominees: USAF, Gen. Nathan Twining; Navy, Adm. Robert B. Carney, and Army, Gen. Matthew Ridgway.

Pending outcome of this study, Defense Secretary Charles E. Wilson has decided to slow the pace of aircraft production and USAF buildup to reach a goal of 120 combat wings by 1955. This compares with the Truman Administration goal of 126 combat wings plus 17 troop carrier wings by the same date.

▶ **Cash Outlays**—Since the revised Republican Defense Department budget (AVIATION WEEK May 25, p. 16) was whipped through the Defense Department and National Security Council so fast that even the Joint Chiefs of Staff saw it only the day before it was submitted to Congress, it is difficult to find firm outlines of a detailed aircraft procurement program in the Pentagon.

It now appears that actual spending for aircraft procurement during fiscal 1954 will be about the same as during fiscal 1953.

Wilson testified before the Senate Appropriations Committee that USAF actually will have spent approximately $6 billion for aircraft during fiscal 1953 which ends next month. This compares with $4.3 billion in fiscal 1952 and $7 billion estimated in the Truman budget for fiscal 1954, indicating that any aircraft procurement reprogramming for fiscal 1954 will involve reductions ranging from $700 million to $300 million from the Truman budget program.

These figures are all actual cash outlays from previously appropriated funds to the industry for aircraft deliveries and are distinct from new appropriation requests.

▶ **Deep Slash**—Wilson is imposing his big cut in the procurement appropriation request for fiscal 1954, slashing from $6.6 billion to $3.4 billion. This plan apparently is based on the following assumptions:

- **USAF will have $22 billion** to finance aircraft production during the next three years. This includes $19 billion in carryover funds from previous appropriations (mostly obligated but not yet spent) plus the $3.4 billion for fiscal 1954. This is expected to finance aircraft production at a rate of about $7 billion annually for the next three years.
- **A further stretchout** in aircraft production by putting the aircraft industry back on a normal single-shift, 40-hr. work week, and eliminating extra shifts and overtime.
- **Major slippages** in aircraft production schedules during the next two years while new models are being brought into production.
- **Consolidating economies** that already are underway in USAF. These include reduced spare parts requirements through more efficient requisitioning procedures and greatly reduced jet engine requirements resulting from longer service life, improved field maintenance techniques and use of airlift in the engine supply pipeline.
- **Elimination of some aircraft** which are considered to be of marginal military value.

▶ **Eisenhower Philosophy**—These assumptions all are part of the Eisenhower Administration's basic philosophy of settling down for a long, steady pull that will maintain some measure of military posture over an indefinite period of time rather than a hurried semi-mobilization to meet a specific crisis.

Critics of the Eisenhower defense program based their attacks on the fact that it presumes Russia will not start a major war in the forseeable future and ignores the continued buildup of Russia's atomic striking power to the point where it soon will be capable of delivering a crippling attack directly on U. S. production centers from aircraft and submarines.

▶ **AF Challenge**—In a Pentagon press conference and testimony on Capitol Hill, Wilson indicated that what he actually means by "cutting lead time" on aircraft production contracts simply is reducing the interval between letting of contracts and deliveries of completed aircraft.

He believes that this interval can be shortened now because the aircraft industry has completed its basic tooling up and expansion period. However, he admits that "lead time" still would be a critical factor in bringing new types of aircraft through their development cycle into production.

Challenging many of Wilson's contentions is a statement prepared at the operating level of USAF Headquarters and submitted to Rep. Samuel Yorty, California Democrat and former Air Force intelligence officer, through the Air Force Legislative Liaison Office, which is headed by Maj. General Robert Eaton.

The USAF statement says the Wilson budget would have the following effects on the Air Force expansion program:

- **Require delay** until fiscal 1956 of some aircraft production now scheduled for fiscal 1954 and 1955 in order to preserve re-order lead time and to maintain a healthy aircraft industry. "Unless this impact is spread over the three-year term, there is a marked danger that large segments of the aircraft industry would be so sharply cut that

USAF Strength

Air Force now has a strength of 103 combat wings but 10 of these are not fully equipped with combat aircraft, according to Defense Secretary Charles E. Wilson.

Rep. Dewey Short, chairman of the House Armed Services Committee, told reporters after a White House budget conference that the Air Force now has 73 combat wings equipped with modern aircraft.

Polish Pilot Describes Improved MiG

By William J. Coughlin

Los Angeles—Lt. Francizek Jarecki, Polish air force pilot who escaped to Denmark in a Russian-built MiG-15, last week gave details of the improved Red fighter he flew to freedom.

He listed these improvements in the new MiG, apparently the same model the Communists have been using in Korean fighting for more than a year:

- **New powerplant**, with thrust up from 4,540 to 5,400 lb.
- **Aileron boost.**
- **Improved gyroscopic gunsight.**
- **Radio compass.**
- **Radio altimeter.**
- **Marker beacon receiver.**
- **Better armament** (the one-37-mm. and two-23-mm. cannon combination now familiar in MiG Alley).
- **Modified cockpit.**
- **Stronger construction.**

In response to AVIATION WEEK inquiries, Jarecki disclosed that his squadron received 14 of the new-type MiGs last February. The young lieutenant said the second Polish pilot who escaped to Denmark May 20 in another MiG was from the same squadron and presumably flying the same model MiG.

"Many more will follow," he predicted, adding that several pilots tried to escape before he did but were shot down.

▶ **Policed Pilots**—Jarecki told of the control system the Russians have established in an effort to prevent such escapes. He said all flights must be cleared with the control center at Warsaw 24 hr. in advance and are restricted to a definite flying area. Four Russian-piloted aircraft remain on alert at all times to scramble after any aircraft which leaves its assigned zone.

"They shoot down any such plane," Lt. Jarecki said through an interpreter.

▶ **Flight to Freedom**—The Polish flier said he planned his own escape in advance of the flight but denied that he received any financial offer from American sources.

"I did not even know of any such offer," he asserted.

Jarecki said he delayed his takeoff by pretending to have trouble with his landing gear and was airborne two minutes behind the other three ships in the four-ship MiG flight. Breaking away from the flight, he flew over a Russian base on the Baltic, 60 mi. west of his Polish station, dropped his tanks on the field there and headed for the Danish base on Bornholm Island.

He was chased by other MiGs, he said, and Danish vessels on the Baltic later reported he was fired upon, although he was unaware of this at the time. Jarecki said he believed he was landing at a U.S. base and was surprised to find himself in Danish custody.

▶ **"Finest Fighter"**—In describing the Russian-built fighter further, Jarecki said the MiG handled nicely in the air.

He said he had heard of aerodynamic difficulties which caused an unrecoverable spin but had encountered no such trouble himself.

Pilots in his squadron, according to Jarecki, are under the impression the MiG-15 is the finest fighter aircraft ever built. The Russians have told them this many times, he said.

▶ **U.S. Orientation**—The Polish lieutenant was in Los Angeles on a tour of North American Aviation's F-86 plant. After inspecting production lines, he spent some time talking with North American designers. Jarecki was accompanied by an Air Force party which included Col. Francis S. Gabreski.

Col. Gabreski said the Air Force was taking Jarecki on a tour of U.S. bases and plants "strictly for orientation." He said there are no plans for the Polish flier to check out in an F-86 in the immediate future.

▶ **Red Training**—The 21-year-old lieutenant said he had a total of 150 flying hr., of which 50 were in the MiG-15. Prior to checking out, he trained in a two-place version of the MiG. The MiG he flew to Denmark was the latest model in Poland, although he believes newer models are in existence elsewhere.

He said he decided to flee Poland because of the unsatisfactory life in his country under the Russians. "We never knew what tomorrow might bring," he commented. Jarecki said his final decision to flee was made after he was asked to do counter-espionage work against members of his own squadron.

Russians fly with the Polish air force "down to the lowest levels—including the squadron level," he reported. He said the Polish air force was given very complete information on Allied aircraft, including dimensions, armament and strength. Russian reports told of many MiG victories over B-29s and other bombers in Korea, Jarecki said, but no mention was made of the fighter warfare with the F-86s.

He said he definitely had been told Russians were flying MiGs in the Korean fighting. At least one Russian officer now stationed in Warsaw is a veteran of the Korean war, according to Jarecki.

▶ **Improved British Sight**—Concerning the MiG gunsight, he said it was a mechanical gyro sight—"a British sight which the Russians have improved." He described his aircraft as a Mach .92, 750-mph. fighter with a service ceiling above 50,000 ft. It does not have elevator boost, he said.

they could not adequately respond to later aircraft orders," the report states.

- **Reduce aircraft deliveries** for the next three years. The statement quotes a reduction of 7% in airframe weight for fiscal 1954 and 19% for the two following years. "It is impossible to measure the full impact of these limitations because the Air Force has been given no specific information on new obligational authority or estimated expenditures for the fiscal years 1955 or 1956," the report says.
- **Impose a personnel limitation** that would make it impossible for USAF to reach a 120-combat-wing strength by 1955.

The AF report says the Wilson budget would result in a strength of 110 wings by June 30, 1954, instead of the 133 originally programmed and calls for 115 wings by the end of 1955 instead of 143. It also says the Wilson 120-wing goal would not be attained until the end of 1956—a year later than Wilson indicated.

Sen. Homer Ferguson, Republican Chairman of the Senate Appropriations Committee, indicates he will call on USAF officers to testify on the Wilson budget in an effort to determine the accuracy of the various statements as to its effect on the USAF program. Retiring USAF Chief of Staff Gen. Hoyt S. Vandenburg and USAF Secretary Harold Talbott will testify today (June 1) in open hearings.

Apparently alarmed by the appearance of some Republicans among the defense budget critics led by Democrat Sens. Stuart Symington of Missouri and Lyndon Johnson of Texas, Ferguson has indicated he will rely on the personal military prestige of the President to push the budget through Congress.

Temco Fights for Slow Cutbacks

McCulloch says air contracts should be decided on basis of efficiency, with preference to firms in aviation to stay.

By Alexander McSurely

Dallas—A canny Scottish-American airplane producer with a long record for low-cost production has launched a vigorous campaign to get "real economy" in the Defense Department's proposed across-the-board aircraft cuts.

Robert McCulloch, president of Temco Aircraft Corp., told AVIATION WEEK in an exclusive interview that he has a counter-proposal that cuts be determined on a production efficiency basis, with the more efficient companies being kept in business.

Whenever there is a choice between equally efficient manufacturers, McCulloch believes the contracts should be awarded to companies who are in aviation to stay rather than those with other peacetime lines.

He also has some ideas about more efficient ways of contract termination that he feels would give the government more for its termination dollars.

▶ **Navy Contract**—McCulloch hurried to Washington last week to give his views to top Navy officials, because his company is the Navy's only second-source producer of a complete airplane, the McDonnell F3H Demon jet fighter. The Temco president feels this contract may be terminated under the plan announced by Defense Secretary Charles E. Wilson to end all second-source airplane production.

Temco also has in production at the plant near Dallas rear fuselage assemblies for Boeing B-47 jet bombers and wings for Lockheed P2V patrol bombers.

A recent analysis showed his company is producing these items at about half the standard industry cost per airplane pound complete with fuel, electrical and hydraulic systems ready to attach to other complete assemblies. A recent production cost estimate for the overall aircraft program was $40/lb., an Aircraft Industry Assn. source said.

▶ **Mustang Production**—Low-cost work at Temco is a re-enactment of what happened during World War II when it operated as a North American Aviation plant, with McCulloch as general manager. In 1945, the plant turned out P-51 Mustangs at the rate of 18 a day plus 12 AT-6 trainers a day, although only 8% of the complete airplanes were subcontracted outside the plant. McCulloch got the manhours on the Mustangs down to the lowest U. S. record for large-scale production in the war, 0.39 hr. per lb.

"If Temco was still the North American Division that it was in World War II, we wouldn't be a second-source producer, any more than North American's Columbus plant is considered a second-source producer. Yet we have many of the same people, and a high efficiency record," McCulloch said.

McCULLOCH: Reward for efficiency.

"The Navy spent $12 million to put this plant in shape as a Navy facility and I don't see how they can let that money just go down the drain."

▶ **Strategic Location**—The Temco chief executive said his plant has a strategic inland location, away from coastal exposure.

"It is difficult to understand how the coastal area plants have so many billions in contracts, while this inland manufacturing area has so little. Convair is stepped down on the B-36; Chance Vought doesn't have very large contracts on the Cutlass; and now we are facing a threat of losing our biggest contract."

▶ **Comparison Yardstick**—McCulloch sees a very definite value to the services in maintaining a comparison yardstick on production costs through second-source producers. Any manufacturer, he feels, will do a better cost job when he is up against the direct competitive measurement of another producer who is making the same airplane.

For this reason, McCulloch believes termination ought to be a more gradual process, perhaps costing more but designed to give the government the biggest dollars' worth for the dollars it spends.

If the cuts were planned in this way instead of as a direct hard and fast chop-off, the government would recover something of value for its termination money, instead of "pouring it down the drain."

Take the case of Temco and the F3H contract, McCulloch said. Temco could finish its tooling and build the first 25 airplanes for little more than it would cost to terminate the contract. With a cutoff now, the government would receive nothing for its money but some incomplete tooling and raw materials.

If the gradual termination policy were to be followed, the government would have:

- **Cost comparison** for the first 25 airplanes.
- **Twenty-five** jet fighters.
- **Complete set** of production tooling.
- **A plant** with workmen trained to make more F3Hs if needed.

▶ **Least Loss**—McCulloch objects to a service policy of taking program cuts "just as they are given, without attempting to interpret them so they can be made with the greatest efficiency and the least loss in aircraft production and potential production.

"It was only about a year ago that some Navy people asked us not to take any more Air Force business in the Dallas plant in an effort to safeguard the F3H program," he said. "But we went ahead on the B-47 rear fuselages anyway. And the Air Force is getting its money's worth. And we are giving the Air Force cheaper overhaul prices on their C-54s down at our Greenville base than they ever thought of getting.

"You know Secretary Wilson made a statement that he wanted to protect the low-cost producers in the Air Force cutbacks. Well, if he only knew it, he may be wiping some of them out of government business."

▶ **Future Plans**—But McCulloch, who built up Temco sales since 1946 to last year's peak of more than $55 million, plans to keep on going as an aircraft business with some new projects, no matter what.

He wants to modify Temco's trainer, the Buckaroo, with a tricycle landing gear; modernize its engine; clean up the structure, and make it the strongest possible low-cost competitor for primary training sales.

McCulloch plans to build at least one of the following projects:

- **Turboprop Mamba-powered trainers,** following the Temco Model 30 design entered in the recent Air Force trainer competition won by Cessna Aircraft Co. McCulloch believes his design is more suitable for a transition from primary training to jets and that the Mamba turboprop engine is better suited for training than the French Marbore jet engines which the Cessna entry specified.
- **A similar trainer** powered by the proposed Allison 520-C1 (turbojet engine

developed from the Allison T-38 turboprop), if the 520-C1 is available.

• **A 10-to-12-place twin-engine transport** powered by two Mamba engines.

▶ **Ambitious Effort**—To handle these and other future projects, McCulloch has assembled a sizable engineering staff headed by H. G. Erickson, director of engineering, and William Hurtt, assistant chief engineer and chief of design, and including a number of engineers experienced in jet powerplants and supersonic aerodynamics.

Their most ambitious effort so far is the Temco design entry in the day fighter Navy competition, won last week by Chance Vought Aircraft. McCulloch would like to build one of these fighters "to show what it could do in actual flight."

▶ **Management Background**—McCulloch and his principal executive coworker, H. L. Howard, organized Temco in 1946 to take advantage of experienced know-how and manpower available in the Grand Prairie neighborhood after termination of North American's wartime activities. Howard had been comptroller of the North American Grand Prairie plant, is now executive vice president and treasurer of Temco.

McCulloch had worked on airplanes in his native Scotland. He came to the U. S. in 1927, got back in aviation immediately as a mechanic at Atlantic Aircraft, which successively became Fokker Aircraft, General Aviation and finally North American Aviation. He climbed the production ladder to become factory manager at North American's main plant at Inglewood, Calif. He left for a job as manager of Convair's Nashville plant but returned shortly to North American as assistant general manager-manufacturing for Inglewood, Kansas City and Dallas plants. Finally, in the latter part of the war, he was made general manager at Dallas and had a chance to concentrate on application of manufacturing techniques.

Industry observers see a resemblance between McCulloch's philosophy and that of J. H. (Dutch) Kindelberger, North American board chairman.

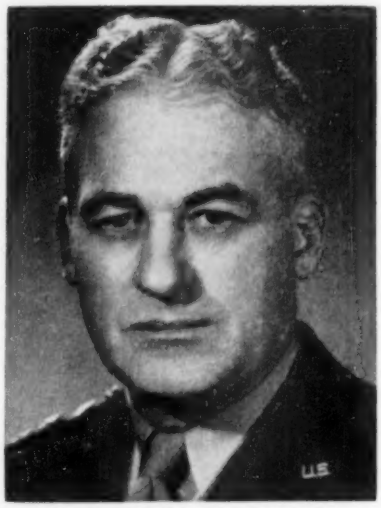
Lightplane Shipments Drop 23% in March

Complete civil planes shipped during March decreased 23% and civilian aircraft engine shipments increased 40% over February shipments.

Monthly joint report of the Census Bureau and Civil Aeronautics Administration reports 358 planes worth a total of $11.7 million were shipped during March. Value of engines was $4.1 million, a 72% increase over February shipments of $2.4 million.

By the end of March, there were unfilled orders for 400 civilian planes, an increase of seven since February. The report of 21 aircraft companies and six engine firms indicates engine shipments during the first quarter of the year were 59% higher than the same 1952 period.

A total of 1,105 complete civilian aircraft valued at $46.6 million were shipped during the first three months. During the corresponding period of 1952, shipments were $44.9 million.



Gen. Nathan F. Twining

Twining's Policy

- **New AF chief strongly defends SAC bombers.**
- **He pins hopes for peace, victory on B-47, B-52.**

USAF Vice Chief of Staff Gen. Nathan F. Twining, assailing critics of long-range bombing, says the Strategic Air Command has the only medium and heavy bombers that "can reach all the targets which would have to be reached at the very outset of a total war."

Observers believe the newly appointed Air Force Chief of Staff intends to make his stand on Air Force policy clear before he succeeds Gen. Hoyt Vandenberg June 30. Heading the New Joint Chiefs will be Adm. Arthur Radford, who in 1949 championed the supercarrier task force over the long-range strategic bombing concept.

▶ **Radar Accuracy**—"Many false statements have been made concerning the difficulties of high-level bombing," Twining told the Aviation Writers Assn. convention in Dallas. "The truth is that the difference in accuracy of bombing from different levels is small.

"In Korea at the present time, radar-controlled bombing from an altitude of several miles is generally more accurate than dive bombing in daylight."

▶ **1,500-Mi. Radius**—On the possibility of war with Russia, Twining contends that smaller planes are no substitute for the big bombers. Long-range bombers are the only aircraft capable of hitting the great concentration of war industry more than a thousand miles inside the nearest Soviet border and "well insulated against any land or sea approach," he says.

"Obviously, we cannot expect to launch our most essential counter-attacks from points so near the Iron Curtain that they would be under constant attack by swarms of Soviet jet fighters and light jet bombers."

U. S. strategic bases should be several hundred miles outside the Iron Curtain, the general says. "Consequently, in order to reach the principal targets that would be marked for atomic destruction, our planes must have more than 1,500 mi. radius of action. . . .

"No military plane has such a range except the land-based heavy or medium bomber—in the U. S. forces only the B-29, B-50, B-47, B-36, and the B-52. Most of the bases which could be well defended against air attack in all-out war are more than 1,500 mi. from the nearest principal target areas in the Soviet Union."

▶ **Beyond Fighter Reach**—Heavy bombers will never substitute for fighter-bombers, Twining says, emphasizing that "the long-range bomber is entirely capable of performing many short-range tasks and of performing them very well from any altitude that may be considered desirable.

"On the other hand, no short-range tactical airplane can carry out the long-range missions of which the strategic bomber is capable."

Since Communists "so greatly outnumber" U. S. fighter planes, "we must depend more heavily on long-range planes that can be kept beyond the reach of most of them," the general says. The Soviet air force has so many more short-range planes, and that, combined with their more numerous bases, will "force us to depend more heavily on our medium and heavy bombers that can strike from beyond their reach."

▶ **B-47 Investment**—Gen. Twining describes as "an excellent investment" the B-47 now supplementing B-29 and B-50 bombers in combat units. He reveals that the 306th Medium Bombardment Wing, first operational unit to be equipped with B-47s, will leave MacDill Field, Fla., early in June for 90 days training in Great Britain.

With the B-47 combined with the B-52 "that we hope soon to produce," the U. S. has more hope for peace or, "if necessary, ultimate victory," Twining forecasts.

AF Opens Andrews To Scheduled Airlines

The nation's capital got a much-needed second airport last week when the Secretaries of Commerce and U.S. Air Force agreed to a plan for joint commercial-military use of nearby Andrews AFB.

Air Force has been opposed to sharing Andrews, although the military utilization is light by commercial standards. President Eisenhower recently stepped in, ended the long Air Force stalemate.

Commerce Undersecretary for Transportation Robert Murray announced the agreement to the Aero Club of Washington last week. He said Commerce had agreed to accept the Air Force proposals in principle. Major conditions are that Andrews must be restricted to:

- **Scheduled airlines only.**
- **5,000 moves per month,** until construction of a parallel runway, 15,000 moves per month thereafter.
- **Terminal facilities** located where USAF decides.

Murray said many details are yet to be ironed out, but the deal is definite, the major agreement is concluded.

Washington National Airport has about reached saturation of terminal loading space, facilities and instrument landing capacity. Washingtonians still insist that Baltimore's Friendship Airport is too far from downtown Washington, especially with the present highway congestion. Previous Congresses and the new Administration balked at the cost of constructing a completely new airport as proposed annually by Civil Aeronautics Administration in the past.

Andrews is only a few miles further away from downtown Washington than the close-in Washington National.

NAA Questions A-Plane Feasibility

J. H. Kindelberger, chairman of the board of North American Aviation, Inc., says that his company couldn't see any possibility of devleoping a practical atomic powerplant for aircraft. Such a plane would be slow and completely uneconomical, he told a New York news conference.

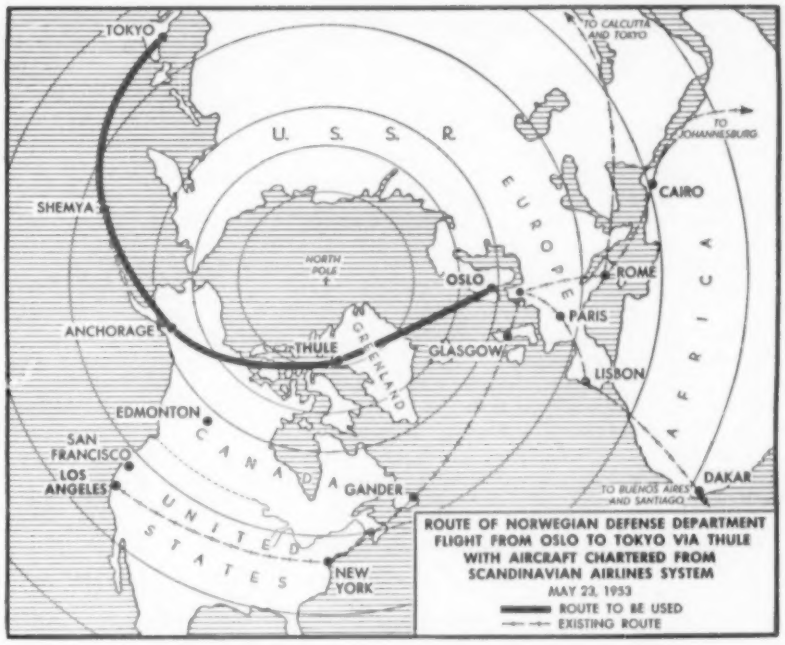
This conclusion was based on post-war studies begun in 1946 by the company in the field of nuclear propulsion for guided missiles and aircraft. Since 1948, North American has been a prime contractor for the division of reactor development of the Atomic Energy Commission.

Now NAA is ready to branch out into a new field of atomic power, Kindelberger said—construction of a pilot plant to demonstrate and produce electrical power from a nuclear reactor.

Kindelberger said the plant could be designed and built "as soon as conditions permit." Cost was estimated at $10 million, and time from contract to operation was placed at two years.

North American's proposed design is similar to conventional coal-burning plants common to many power-generating stations in this country. The big difference: The coal furnace is replaced by a reactor unit.

North American developed the design under contract with the Atomic Energy Commission as a pilot unit to demonstrate and study the production of electrical power. Output is 8,000 kilowatts, about one-twentieth that of commercial power-generating stations.



SAS Flies Polar Routes to Tokyo

Scandinavian Airlines System cut Europe-Orient flight time almost in half last week, flying a Douglas DC-6B from Oslo to Tokyo over the North Pole region in 35 flight hours.

Next step for SAS is to get U.S. Civil Aeronautics Board permission to fly scheduled trans-Polar service across Alaska to the Orient and down through Canada to the U.S. West Coast.

The airline made two similar record-breaking flights last year, delivering its new DC-6Bs from the Douglas plant at Los Angeles across the Arctic to Oslo.

▶**6,700-Mi. Route**—Last week's 6,700-mi. special flight touched at three points: Thule, Greenland; Anchorage, Alaska, and Shemya, Aleutions. The transport's 11 crewmen and 41 special passengers broke their trip to stay overnight at Anchorage.

Company spokesmen claim they can get flight time down to about 28 hr.

▶**U.S. Opposition**—The Scandinavian countries last year applied to the U.S. government for amendment of the bilateral air agreements to permit SAS trans-Polar operation to the Orient via Alaska and direct to the U.S. West Coast. State Department passed this application on to CAB. The Board hasn't acted on it yet, and says the Scandinavians have not yet requested necessary "consultations."

U.S. carriers say the trans-Polar operation cannot yet pay its way, and they oppose granting the routes to SAS without getting some concessions from the Scandinavian countries in return. Since the U.S. already has landing rights in Scandinavia, there's not much more the Scandinavians can offer.

Washington observers expect some delays in U.S. granting of the new route to the Scandinavian countries, but believe the U.S. cannot long stand in the way of the venture.

▶**PAA Interest**—When the Scandinavians come to consultations with CAB for the trans-Polar route, Pan American and perhaps Northwest Airlines probably will ask CAB for similar routes.

PAA's certificate already permits landing in the West Coast, Alaska and Greenland. Northwest flies the Seattle-Alaska-Shemya-Tokyo route.

More CAA Changes Coming, Murray Says

Recent Commerce Department action eliminating 18 CAA airport control towers, 40 weather stations, 13 safety inspection offices, four CAA regional administrations, all federal aid for new airport construction, and killing the giant Burke Airport program near Washington is only the beginning, according to Commerce Undersecretary Robert Murray.

"You will begin to hear about changes in that vast (CAA) organization in the coming few months," he told the Aero Club of Washington last week. Murray and CAA administrator Fred B. Lee are "re-examining" all the functions of the federal government in aviation business.

Other highlights of Murray's talk:

• **Industry cooperation.** He disagrees with only two of 10 major CAA policy changes recommended to him by the Air Transport Assn. One of those programs he agrees with is the consolidation of CAA regional administrations—which his staff decided upon independently of the airlines. CAA recently put this plan into action.

• **CAA advisory service.** He plans to turn over to the Airport Operators Council the CAA's advisory service to small operators. He said AOC "is going to render municipal service better than we can."

• **Federal aid.** Murray says Commerce "called a halt to" all federal aid for new airport construction "until we can see where we are going, and wherever we go we're not going to sell federal aid." Commerce's mission is to "promote" aviation development, "but you have to break a few eggs to make an omelette."

• **CAA education service.** CAA will curtail its educational service. Industry people in the field can do a better job in many instances, according to Murray.

▶ **Republican Policy**—The new Administration's policies with regard to civil aviation as outlined by Murray:

• **Minimum government participation** in transportation business.

• **End of government "harassment"** of business.

• **Maximum private ownership** in transport business.

• **Review of federal-state-municipal** relationships and responsibilities.

On the last score, he says he has been trying to get the Commerce staff to get out in the field and see just how much the municipalities can do for themselves without federal meddling. He adds that it is amazing what municipalities can do under the spur of their competition with rival cities.

Vought Fighter Wins Navy Competition

Chance Vought Aircraft won Navy's day fighter competition with a variable-incidence-wing-design plane powered by a Pratt & Whitney J57 with afterburner.

First flight of the new fighter production model is expected by the end of 1956, provided Navy orders the design soon.

Chance Vought won the day fighter competition over seven other aircraft manufacturers including Temco, North American, Douglas, Northrop and McDonnell.

▶ **Attack Type**—Conceived during the last quarter of 1952, the day fighter is the first newly designed aircraft at Chance Vought since 1946 when the F7U-1 Cutlass came off the drawing boards.

When Navy orders the new fighter into production, Vought will be continuing a line of carrier attack-type aircraft like the F7U-3 Cutlass currently in production. That sweptwing, tailless fighter, which first flew Dec. 20, 1951, is a larger version of the original F7U-1 Cutlass.

▶ **Regulus Program**—Employment at Chance Vought, a division of United Aircraft Corp. has grown this year to 11,600, with 80% involved in F7U-3 production at the Dallas plant. Remainder are working on minor subcontracting projects and CV's guided missile, the Regulus.

Begun in 1947, the Regulus program still is being developed. At the same time, the missile is being produced behind canvas curtains in the Cutlass-jammed plant. Regulus is designed for launching from submarines, surface ships and shore bases. It was launched first in 1950, and its existence was announced for the first time this spring (Aviation Week Apr. 6, p. 15).

▶ **A2U-1 Output**—Production is scheduled to begin in September 1954 on Vought's A2U-1 Cutlass when output of the F7U-3, which it replaces, will be drawing to a close. The A2U does not differ either in configuration or size but will be modified from the F7U-3 by strengthening external stores structure, enabling the fighter to carry a greater bomb load—including an atomic bomb. The fuel system also will be re-arranged.

A2U-1 will be powered with twin Westinghouse J46s, as are later production models of the F7U-3. Earlier versions of the F7U-3 were powered with Allison J35s.

Italy Delivers Radar Sets

(McGraw-Hill World News)

Rome—The Italian air force has taken delivery of four radar locating sets from the Microlambda factory at Fusaro near Naples. The United States reportedly furnished the necessary funds.

FIRST WINDOWLESS DC-6A DELIVERED TO AA

Here is the first Douglas DC-6A all-cargo plane featuring a windowless cabin. First of three such freighters ordered by American Airlines, the transport has gone into service between Chicago and New York, making five roundtrips weekly. The second and third DC-6A Airfreighters are scheduled to be delivered to the carrier in July when AA will begin coast-to-coast cargo service between New York and Los Angeles via Detroit and Chicago five times weekly. These DC-6As have 5,000 cu. ft. of unobstructed cargo space and can carry 28,500 lb. of freight. Engines are four P&WA R-2800-CB17s of 2,500 takeoff horsepower each.

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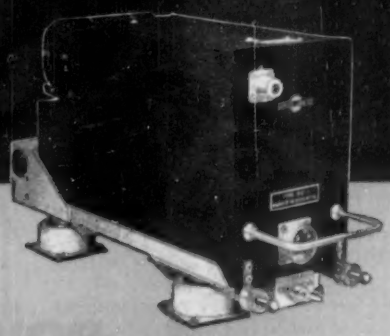
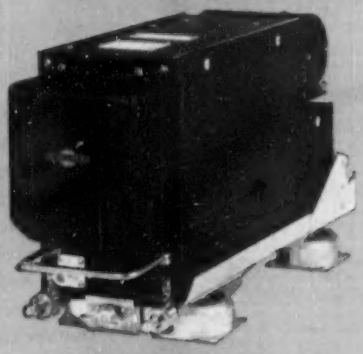
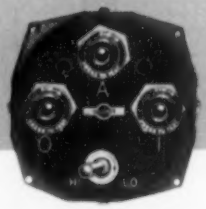


51Z Marker Beacon Receiver



51V-2 Glide Slope Receiver



Collins 3 Light Indicator

COLLINS 51V-2 Glide Slope Receiver

Developed expressly for commercial airline and corporation aircraft . . . not a military development. The 51V-2 is designed to ARINC Specification #519 as revised during April, 1952 — it incorporates the most desirable characteristics of a Glide Slope Receiver according to leading airlines. The RF section's AGC is essentially flat, being less than 1.0 db from 700 to 14,000 microvolts and 1.50 db from 700 to 100,000 microvolts. This feature, together with 12 db audio feedback and voltage regulated AGC delay bias, permits setting of the flag current to lower limits which give better alarm indication. A most outstanding feature of the 51V-2 receiver is its stability of deflection characteristics with reduced tube transconductance and changes in line voltage. ARINC tubes are used throughout the receiver. Conducted and radiated interference has been reduced. Susceptibility characteristics are unusually good; spurious responses are approximately 70 db down. The 51V-2 is electrically and mechanically interchangeable with its forerunner, the Collins 51V-1. Both AC and DC power supplies are interchangeable on the two models.

COLLINS 51Z-1 Marker Beacon Receiver

Another performance-proved aviation aid designed to round out the Collins line. The 51Z Marker Beacon Receiver, fixed tuned to 75 MC, uses either AC or DC power . . . the same power supply used in 51V Glide Slope Receivers. Rear plug connection for use in Collins 350B extractor-type shockmount. Spurious frequency response is 75 db down from desired frequency, less than 10 microvolt RF radiation. Excellent squelch characteristic curve minimizes twilight indications. A single short ½ ATR case is used. Its construction is similar to that of the 51V receiver case. ARINC tubes are used throughout. The 51Z is designed to meet forthcoming ARINC specification on Marker Beacon Receivers.

Collins-designed 3 light indicator has standard Hi-Lo switch and push-to-test indicator lamps. The lights and switch are also available in kit form if it is desired to mount the marker indicator lights on the aircraft panel vertically, horizontally or differently than the standard triangular mounting pattern.

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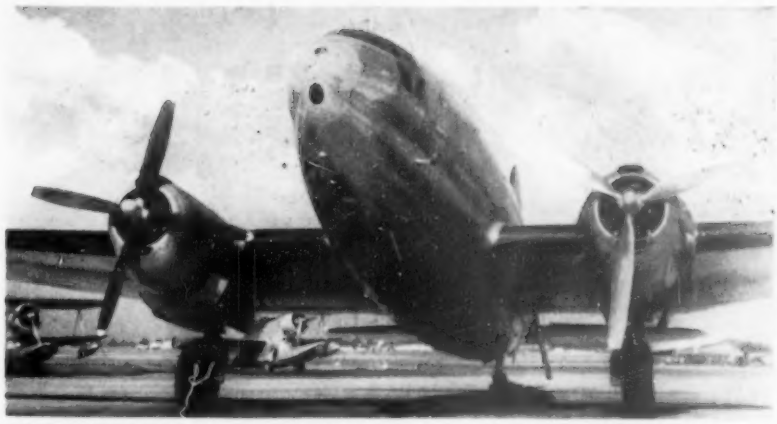

NEW C-46 NACELLE, shown with three-bladed propeller, successfully hurdles . . .

CERTIFICATION TESTS, which show the modification gives better engine cooling.

Modified C-46 Passes First Test

Modified Curtiss C-46 has cleared the first Civil Aeronautics Administration certification hurdle with successful flight tests of the transport's new engine nacelle. Cylinder head and oil cooling exceeded CAA safety requirements.

Next step in the C-46 modernization program by American Airmotive, Miami, Fla., is installation of the more powerful CB-16 version of the Pratt & Whitney R2800 engine (AVIATION WEEK Feb. 23, p. 13). The new powerplant will increase the transport's total take-off power by 800 hp. The new nacelle is designed to take the CB-16 engine.

▶ **Additional Changes**—Airmotive plans the following additional modifications to bring the two-engine aircraft up to modern transport category certification weight, estimated at 49,000 lb.:

- **Automatic prop** feathering.
- **Hytrol brake** meter system, improving braking efficiency.
- **Control surface** rework to overcome problem of controlling increased torque on a single-engine climb.

Projected gross weight near 49,000 lb. compares with a temporary Civil Aeronautics Board permit allowing C-46 passenger operation at 44,300-45,000 lb. and a threatened CAB cut to less than 40,000 lb. at the end of this year.

▶ **Nacelle Test**—Flight tests for CAA certification showed maximum cylinder temperature of 223C indicated, 250 corrected on an engine-out climb. Maximum oil temperature of 87C indicated compared with 100C permitted by Pratt & Whitney and Air Force and 93C by CAA. Airmotive's program calls for a newer oil cooler than the one used in the test plane, further reducing oil temperature.

The new nacelle has a stainless steel firewall and complete fire zone detection and protection system.

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negotiating with Airmotive to make the nacelle change on their C-46s. They also are contemplating the next step with Airmotive—conversion to CB-16 engine. Avianca (Colombia) uses the Curtiss transport for cargo, Lacsa (Costa Rica) for passengers.

▶ **Joint Effort**—Airmotive is working with representatives of United Aircraft, CAB, CAA, C-46 Engineering Foundation (C-46 operators joint effort at improving the plane's service and performance) and individual carriers. Air Force also has a technical observer studying the program.

An alternative plan of some C-46 operators is to install a small external jet engine for emergency power. This would be cheaper than the American Airmotive program, but performance would not be the same.

▶ **Interim Regulation**—Meanwhile, operators of C-46s that have the Hamilton Standard aluminum propellers have won CAB permission to increase gross weight from 44,300 to 45,000 lb. by clipping blade diameter from 6 to 9 in., a modification that yields greater takeoff efficiency. But the special regulation expires Dec. 31, deadline set by CAB for recertification.

American Airmotive says it cannot complete the C-46 modernization for carriers by that time, but probably can do so in early 1954.

CAA Adopts New Runway Markings

New Civil Aeronautics Administration airport runway marking standards range from elaborate requirements for large airports with all-weather runways and high-density traffic to minimum requirements for small fields with VFR.

The new system has been tested in actual use at New York's La Guardia and Newark Airports. It has the approval of Air Line Pilots Assn., Air Transport Assn. and Airports Advisory Committee of CAA. International Civil Aviation Organization is expected to complete adoption of similar standards shortly so that the runway marking system will be uniform at major air terminals throughout the world.

The system includes three types:

- **All-weather.**
- **Basic instrument** runways with navigation aids.
- **Visual flight** rule runways.

Details of the centerline markings, runway designations, threshold markers, landing zone markers, side stripes if required, and taxiway and holding-line markers are in the new technical standard order N10A issued by CAA.

Airports requiring deviations from the new standards are expected to notify the CAA standardization coordinator, Washington 25, D. C.

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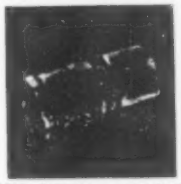
AI-11072 Army-Navy type UG-21D/U improved type N plug for use with RG-8, 9, 9A, 10/U cables. Weatherproof. Teflon insert, neoprene mating seal gasket, silicon rubber cable clamp gasket.



AI-11070. Army-Navy type UG-184/U, type LC plug for use with RG-17, 18/U cables. Weatherproof. Silicon rubber gaskets.

AI-11032 Army-Navy type UG-37A/U high voltage pulse receptacle pressurized. Ceramic insert, neoprene rubber gaskets.

AI-11022. Special type BNC high voltage plug. Mates only with high voltage receptacles and jacks, for use with RG-59/U cable. Weatherproof. Teflon insert. Neoprene rubber gaskets.

AI-11006. Army-Navy type UG-359/U Klystron Coupler. Weatherproof. Styrene Copolymer and linen base bakelite inserts. For use with klystron tube 725C.

AI-11030. Army-Navy type UG-306/U, type BNC right angle adapter. One male, one female end. Weatherproof. Teflon inserts. Neoprene rubber gasket.

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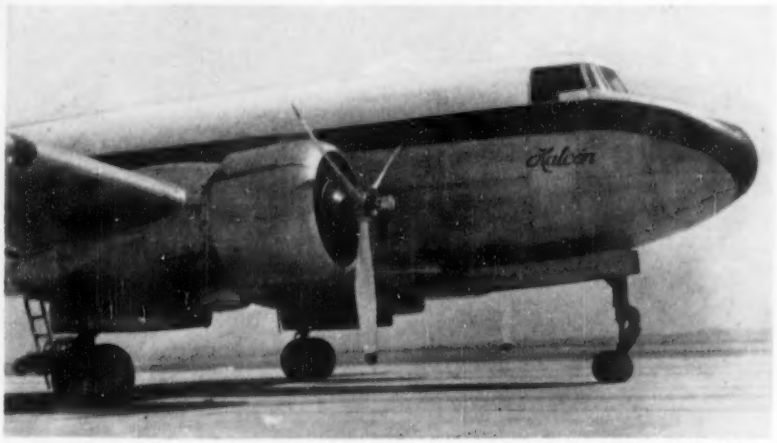
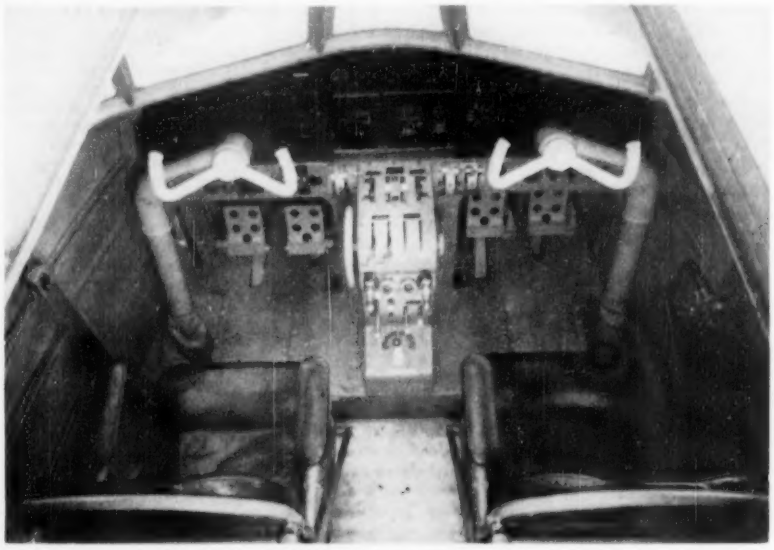
New Spanish Transport Is Tested

CASA 202 HALCON, recently started on a flight test program, is the second twin-engine transport designed and built by Construcciones Aeronauticas S.A. Madrid. It carries 14 passengers, crew of three. Span is 70 ft. 9 in., length 51 ft. 10 in., and height is 13 ft. 11 in. Empty weight is 10,250 lb., gross weight is 16,500 lb.



NOSE CLOSEUP of Halcon provides a good look at cowling of starboard 9-cylinder 750-hp. Elizalde 9C-29-750 engines. Note small dual nose wheels. CASA 202 has a design top speed of 214 mph. at 9,315 ft. and a cruising speed of 166 mph.



HALCON COCKPIT is simply furnished compared with U. S. standards. Instruments include night flying equipment. Cabin is air conditioned but is not pressurized.

Senate Asks Paring Of Windtunnel Costs

Senate Appropriations Committee has asked General Accounting Office to investigate operation costs of windtunnels by various government agencies.

Senators want GAO to recommend a plan for "centralized use of such huge facilities to the end that economies may be effected in the use of power as well as personnel."

The committee made the recommendation in reporting out National Advisory Committee for Aeronautics' fiscal 1954 appropriation, which it cut to $62.4 million. Truman budget called for $77.6 million. The House allowed $64.4 million.

NACA research director Dr. Hugh Dryden testified he was "reasonably well pleased" with the budget as approved by the House. "We were granted substantially the full amount of the revised budget, the revision being based on a policy of deferring certain items of construction."

Turboprop Airliners First, Says Hibbard

Passenger seat-mile costs lower than present bus fares are possible using new turboprop engines, says Lockheed's vice president-engineering Hall Hibbard.

The transport plane designer envisioned the propeller-turbine configuration as the interim step to jets at a recent meeting of the Security Analysts of San Francisco. In so doing, he gave added weight to recent similar support for the turboprop expressed by Eastern Air Lines' president E. V. Rickenbacker and American Airlines' president C. R. Smith (see AVIATION WEEK May 18, p. 26 and May 11, p. 102 respectively).

▶**Must Be Sound**—Turboprop aircraft are now being built, Hibbard reported, apparently referring to the Navy R7V-2 Super Connie which is to be fitted with P&WA T34 engines. But economical purejet airliners still are five years away, he stated.

The new planes must have a sound dollars-and-cents basis, said the Lockheed executive engineer. "A technically good jet transport would be inadequately designed if it should lack profit-making capability."

Hibbard saw turboprop engines extending the Constellation series' life ". . . well through the 1960s."

He also referred briefly to the ducted fan type of jet powerplant, now under active study, as ideal for a revolutionary family plane capable of attaining 500 mph. in level flight. "Such a plane," he said, "could be common in 20 yr. at prices comparable to the automobile."

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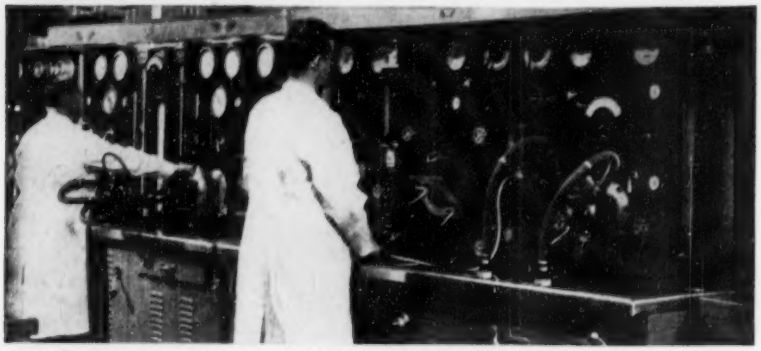


Greer Vacuum Pump Test Stand (*left*) is used by Trans-Canada to test vacuum pumps up to .5 inches of mercury, 80 cubic feet air per minute capacity. Greer Dual Fuel Pump Test Stand (*right*) accurately tests both engine driven and electrically driven pumps.

How Trans-Canada Airlines Tests Two Components at Once

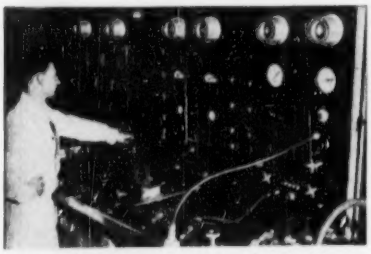
Trans-Canada flies its famous North Star planes on a busy schedule over two continents. The idea is to keep these planes in the air—and this means test and maintenance must keep pace.

The airline asked Greer to adapt its standard test equipment so that one machine could handle two components simultaneously. Photos on this page provide the evidence that this specification was successfully met.

Trans-Canada, like other leading airlines, will vouch for the dependability of Greer equipment. Each machine is slowly and painstakingly produced, carefully tested in each stage of production for highest order accuracy and long service life.

The men who design and build them have many years of very specialized experience in this narrow field. It is experience that is difficult to find, perhaps impossible to match elsewhere.

These men know well that each machine carries their reputation on its nameplate. This is your absolute assurance of complete satisfaction with Greer Test Machines.



Greer Anti-Icing Pump and Distributor Valve Test Machine, shown in operation at Trans Canada, checks anti-icing pump and performance of de-icer distributor valve.

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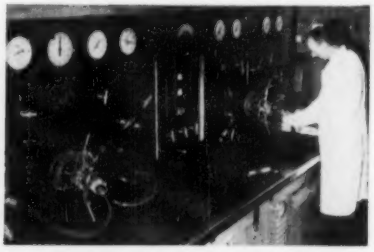
Greer Stationary Hydraulic Accessories Test Machine fully checks all hydraulic system accessories including the system pump, includes a 25hp variable speed drive.



Greer Hydraulic Pump Test Machine tests aircraft engine hydraulic pumps rated at 3400 psi and flow rates to 10 gpm. Accepted for use by USAF and foreign countries.

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PAA President Takes $3,125 Salary Cut

Annual salary of Juan T. Trippe, Pan American World Airways president and director, was cut last year from $23,125 to $20,000, the carrier reports to Civil Aeronautics Board.

Salaries and other compensation paid in 1952 (with comparable 1951 figures shown in parentheses where changes occurred):

Trippe, fees $2,400 ($1,850), 29,039 shares common stock; S. F. Pryor, vice president, assistant to president and director, salary $27,000 ($26,042), other compensation $12,000, fees $2,350 ($2,150), 5,415 (5,169) shares; J. C. Leslie, vice president and director, salary $26,000 ($23,208), other compensation $10,000 ($7,500), fees $1,300 ($1,200), 531 (1,177) shares; H. J. Friendly, vice president, general counsel and director, salary $27,000 ($25,083), other compensation $12,000, fees $900, 2,913 shares; J. S. Woodbridge, comptroller, salary $21,000 ($18,875), other compensation $7,000, 459 (604) shares; R. G. Ferguson, treasurer, salary $21,000 ($18,583), other compensation $7,000, 648 (604) shares; H. P. Morris, secretary and general attorney, salary $14,000 ($13,042), other compensation $2,500, 1,159 (1,268) shares; W. L. Morrison, vice president Latin America Division, salary $25,000 ($24,042), other compensation $9,000 ($10,000), 9,569 (9,384) shares; H. R. Harris, (former) vice president Atlantic Division, salary $25,000, other compensation $9,000, 676 (491) shares; C. M. Young, vice president Pacific-Alaska Division, salary $21,000 ($20,042), other compensation $4,000, 405 (323) shares; H. E. Gray, vice president Atlantic Division, salary $25,000 ($22,875), other compensation $9,000, 1,822 (1,637) shares; H. W. Toomey, vice president, salary $1,667, other compensation $208, 51 shares; Anne M. Archibald (deceased), assistant vice president and assistant secretary, salary $13,500 ($12,542), other compensation $4,000, 1,309 (1,427) shares; E. Balluder, vice president, salary $25,000 ($24,042), other compensation $10,000, 14,750 (14,545) shares; F. Gledhill, vice president and director, salary $27,000 ($25,083), other compensation $12,000, fees $1,300 ($1,100), 2,479 (2,233) shares; H. M. Bixby, vice president and director, salary $14,000 ($13,042), other compensation $5,000, fees $1,750 ($1,600), 8,103 (7,470) shares; J. H. Towers, vice president, salary $1,667 ($20,000), other compensation $250 ($5,000), 702 shares; A. P. Adams, vice president, salary $22,000 ($5,750), other compensation $7,500 ($2,500), 109 (108) shares; R. B. Adams, vice president, salary $20,000 ($8,333), other compensation $4,000 ($2,500), 209 (108) shares; W. G. Lipscomb, vice president-traffic & sales, salary $25,000 ($22,875), other compensation $9,000, 2,616 (2,431) shares; A. A. Priester, vice president and chief engineer, salary $20,000, other compensation $5,000, 4,623 (4,520) shares; H. H. Berke, asst. vice president, salary $18,000 ($17,042), other compensation $5,000, 538 (635) shares; J. C. Cone, asst. vice president, salary $16,000 ($15,042), other compensation $5,000, 3,781 (6,128) shares; W. J. McEvoy, asst. vice president, salary $12,791 ($12,000), other compensation $2,500 (none), 3,007 (3,056) shares; J. D. Fenton, asst. vice president, salary $17,000 ($16,042), other compensation $4,000, 255 (173) shares; A. Hiatt, asst. comptroller, salary $11,000, other compensation $1,500, 780 shares; R. P. Monson, asst. treasurer, salary $14,000 ($13,042), other compensation $4,000 ($3,500), 634 (452) shares; E. G. Rothrock, asst. secretary, salary $9,724 ($8,300), other compensation $750, 32 shares; J. J. Cantwell, asst. secretary, salary $8,373 ($7,389), other compensation $500.

Other directors: S. M. Fairchild, fees $1,300 ($700), 20,700 shares; R. V. Fleming,

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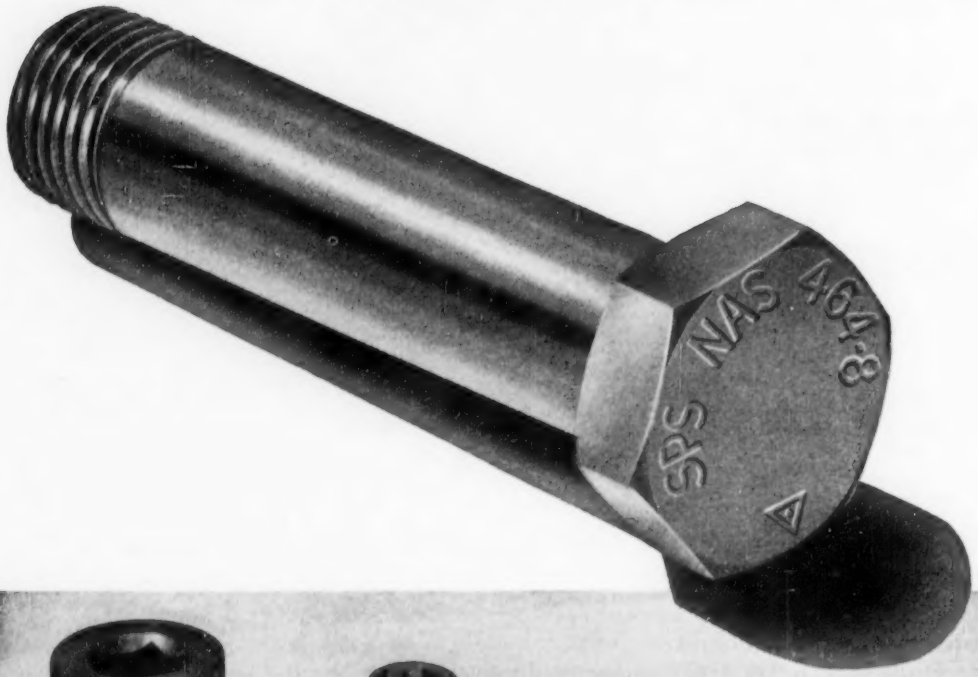

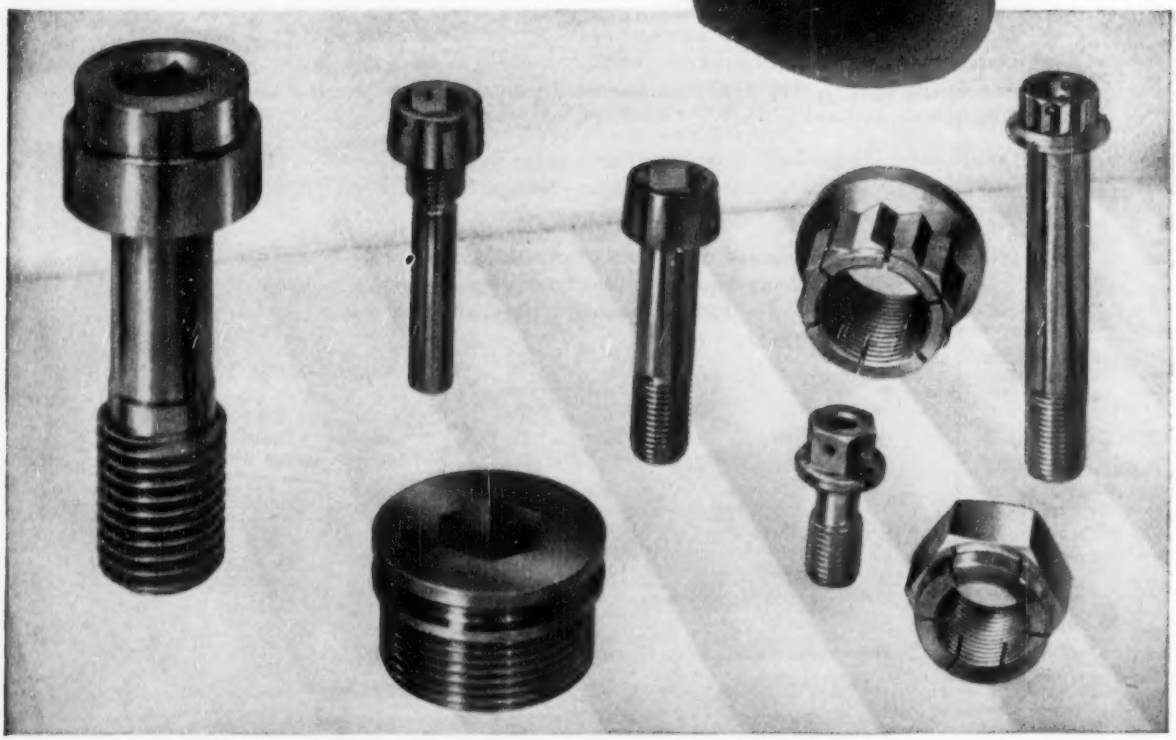

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fees $1,100 ($800), 100 shares; M. Griswold, fees $1,000 ($1,200), 200 shares; R. L. Hamill, fees $500, 1,000 shares; D. S. Ingalls, fees $1,100 ($700), 1,344 shares; R. Lehman, fees $1,100 ($900), 1,300 shares; E. O. McDonnell, fees $5,000, 100 (none) shares; M. T. McKee, fees $5,000, 200 shares; W. H. Standley, fees $600 ($900), 100 shares; R. T. Stevens, fees $1,000 ($600), 1,000 shares; V. F. Taylor, 2,000 shares.

Persons and firms other than company officials receiving $10,000 or more for the year: Julius Klein, Chicago, public relations, $25,200 ($12,000), Steptoe & Johnson, Clarksburg, W. Va., legal, $18,000; Ernst & Ernst, New York, industrial engineering services, $64,070 ($20,892); Loomis, Suffern & Fernald, New York, accounting, $137,275 ($131,700); Cleary, Gottlieb, Friendly & Hamilton, New York, legal, $23,564 ($22,905); Lowell A. Mayberry, Boston, labor consultant, $43,000 ($30,000); Skadden, Arps & Slate, New York, legal, $19,902 ($20,123); Paul Aiken, airmail traffic consultant, $12,000.

No person holds 5% or more of the outstanding stock.

Slick Reports Top Salary of $18,900

Slick Airways, Inc., paid its president, Thomas L. Grace, $18,900 during 1952, the firm reports to the SEC.

Other salaries: William E. Hollan, executive vice president, $16,894; Joseph F. Grant, vice president and secretary, $14,824; David R. Stewart, vice president and treasurer, $15,451; Henry P. Huff, Jr., vice president-operations $14,824; Matthew C. Wilkin, vice president-sales, $14,824; John W. Walbert, assistant secretary, $8,434; and Edwin B. Warwick, assistant treasurer, $6,771.

Rome Builds New $20-Million Airport

(McGraw-Hill World News)

Rome—Work has begun on a new 1,630-acre, $20.8-million air terminal at Fiumicino, 15 miles from the Italian capital. First construction stage is scheduled for completion in approximately 15 months.

Two asphalt runways now being built will be 10,800 ft. long and approximately 200 ft. wide, with borders of approximately 300 ft. on each side.

Actual work on the project began approximately three months ago, and contracts awarded total $6.4 million.

Hungary Flies Air Taxis

Air taxi service at approximately 28 cents per mile has been introduced in Hungary. Equipment consists of Russian-designed PO-2 single-engine two-passenger biplanes.

Air carrier charter service also is available at 56 cents a mile in small twin-engine, Czech-designed Aero 45 transports seating three passengers. Operation is handled by the Hungarian-Soviet Civil Air Service Co.

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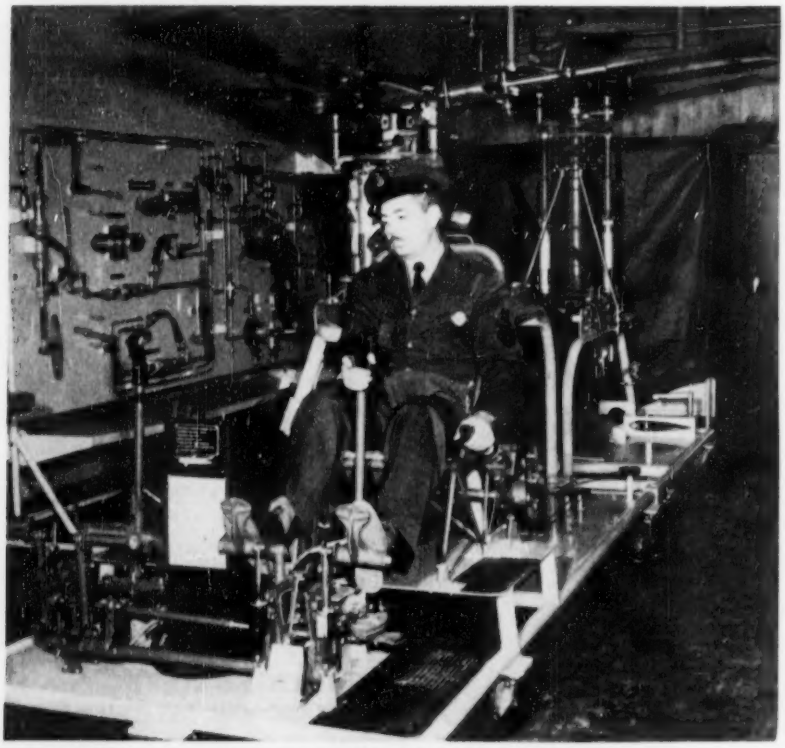
PIASECKI HUP-2 (left) and HUP-1 (right) maintenance can be taught more simply with new trainer built by Burton-Rodgers.

Trainers Ease HUP Copter Servicing



TRAINER 5 is composite transmission, control and rotor system of HUP copters.

- **Mobile units will train Navy teams on-the-spot.**
- **Other service rotorcraft to get similar setups.**

By David A. Anderton

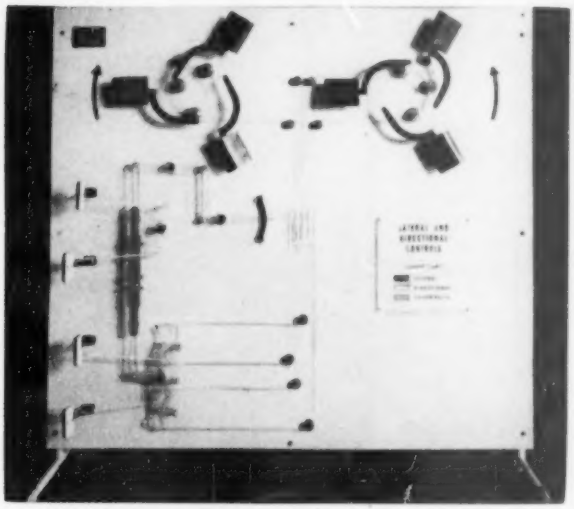
Morton, Pa.—The first mobile maintenance trainer for helicopters, designed and constructed for Piasecki Helicopter Corp. by Burton-Rodgers, Inc., is now helping to train Navy ground crews who service Piasecki HUP copters.

Details of this new training device were explained to AVIATION WEEK by E. A. Ritti, of Piasecki's service department, which spearheaded the design, and by instructors of the Naval Air Mobile Training Detachment during their familiarization course with the unit.

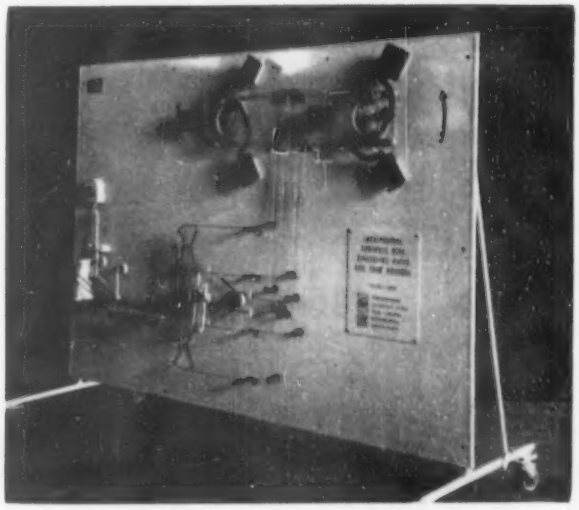
In its present form, the trainer consists of a series of animated panels, as well as panels using the actual components of the helicopters. Major unit of the trainer is a detailed cutaway transmission system, complete from pilot control column to rotor blades.

▶ **BuAer Idea**—The idea of the trainer originated with the Bureau of Aeronautics' Maintenance Division person-

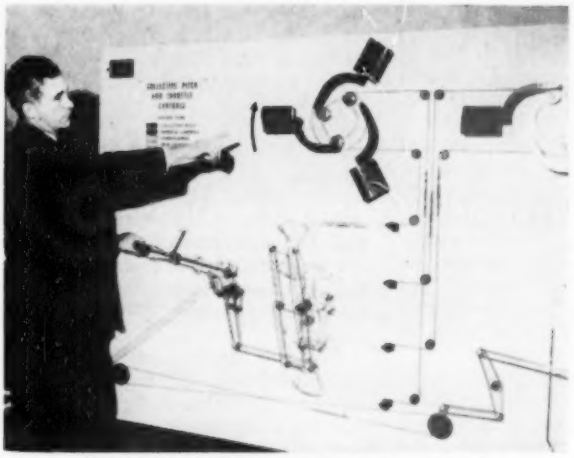
Panels From Mobile Helicopter Maintenance Unit



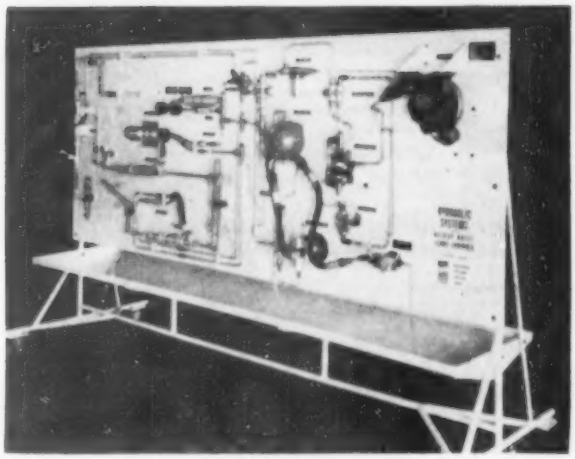
Trainer 1A: Lateral and directional controls.



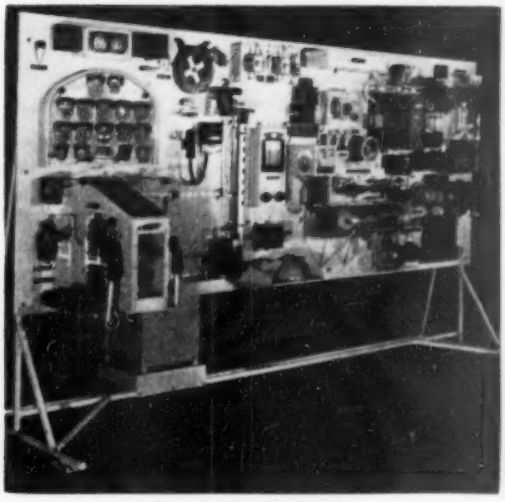
Trainer 1B: Longitudinal controls.



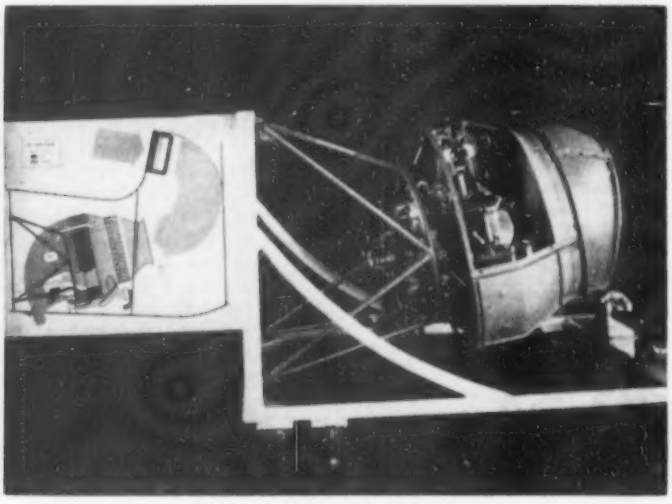
Trainer 1C: Collective pitch, throttle controls.



Trainer 2: Hydraulic systems.

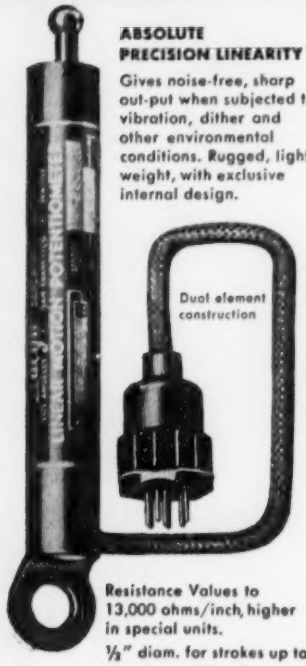


Trainer 3: Electrical system.



Trainer 4: Engine cooling system.

HUMPHREY LINEAR POTENTIOMETER



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nel, including the MA-34 group, after it had been realized that factory training would not handle the job of instructing maintenance personnel.

Plans for the trainer were finalized in September 1951 at a meeting of BuAer, Naval Air Technical Training Command and Naval Air Mobile Training Detachment personnel with the Piasecki representatives.

As a result of this pioneering effort, other trainers are being constructed along similar lines for other service helicopter types.

► **Trainer Makeup**—The entire trainer is composed of six panels, each referred to as a trainer by the Navy. Of these six panels, the first—a trainer for simulated flight control—is subdivided into three panels. Thus there is a total of eight components in the complete unit.

The first trainer gives a breakdown of the flight control system for the copter. This is normally a tough job for instructors and students alike in the case where an actual helicopter—with its extremely complex rotor control system—must be used for instructional purposes. In the Piasecki trainer, the blade control system has been broken down into its basic building blocks which form the complex structure for controlling the rotor hub.

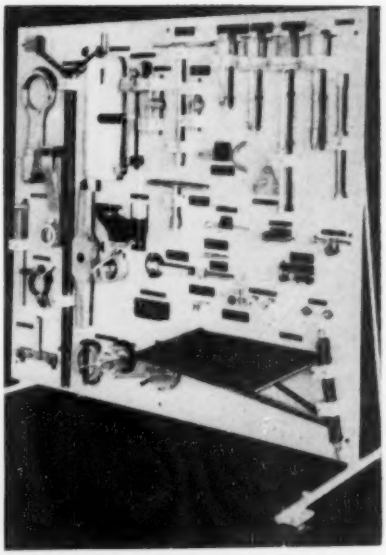
Each of the three panels which makes up the flight control system trainer is topped by a pair of highly simplified rotor hubs, each with three stub blades attached. Control cables run from the appropriate part of the hub mechanism through fairleads and over pulleys, and join the hub with plastic silhouettes of the controls in the cockpit.

• **Trainer 1-A** is for simulation of the lateral and directional control problem. It is the simplest of the three control system trainers and demonstrates the use of the copter rudder pedals, lateral stick and boost control.

• **Trainer 1-B** duplicates the longitudinal control system of the HUP series with differential collective pitch and trim control. This panel shows the effect of the pilot's hand controls—the collective pitch control lever and the cyclic stick—together with the hydraulic boost and all the control components.

• **Trainer 1-C** is used for instruction in collective pitch and throttle control systems. It is built around the action of the collective pitch lever on the rotor blade and includes the linkage between that lever and the engine carburetor for automatic throttle synchronization.

• **Trainer 2** is a duplication of the entire hydraulic system, including the rescue hoist and flight boost control. In addition to demonstrating normal operation and maintenance procedures, this trainer can be deliberately caused to malfunction, thus furnishing a problem for the student maintenance man.



Trainer 6: Special tool panel.

Since hydraulic power for the system normally comes from an engine-driven pump, a separate pump driven by an electric motor is supplied with this particular panel for each section of the system.

• **Trainer 3** is a duplication of the helicopter electrical system with a few exceptions. Heater operation, for example, is demonstrated with colored lights; operation of the fuel quantity gage is done with a rheostat instead of using a quantity of gasoline. The instrument panel does not mount the actual units, but merely reproductions of the indicator faces.

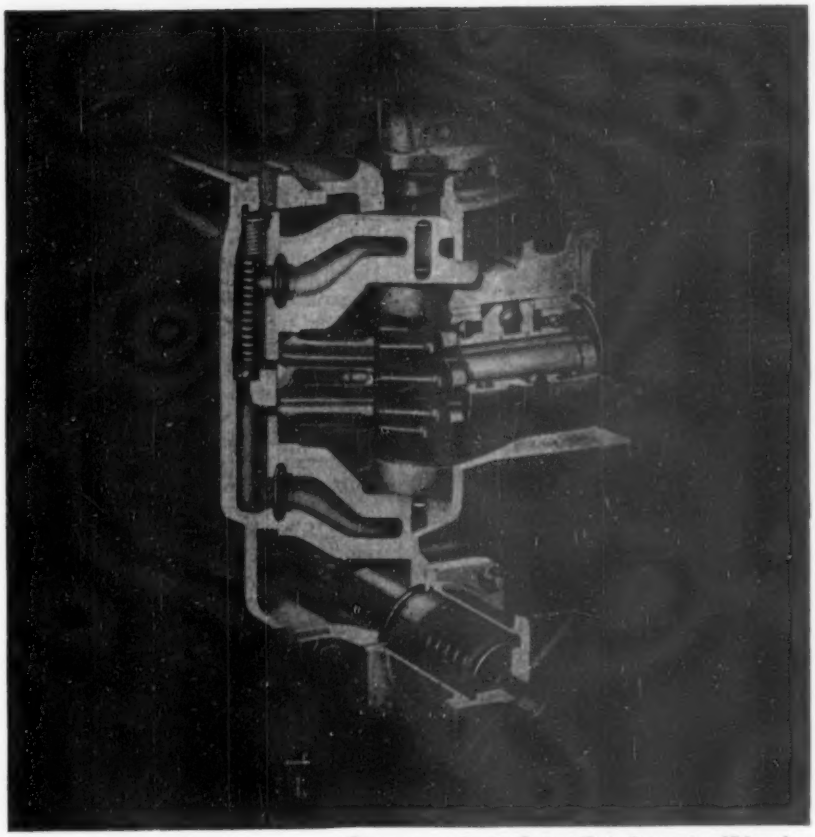
The only criticism of the entire six-unit trainer was voiced by a Navy instructor about this electrical panel; he said that its familiarization qualities were excellent, but that the maintenance and malfunction features were rather limited. He pointed out that faults frequently occurred in the instrument itself, but that since these were simulated by photographs it was obvious that such faults could not be duplicated with the trainer.

• **Trainer 4** is for the engine cooling system; it consists of a complete engine plus fan and cowl panels mounted on a stand. The engine itself, a Continental R975, was beautifully sectioned by the Naval Air Mobile Training Detachment at Memphis for Burton-Rodgers.

Primary purpose of this trainer is to demonstrate the flow of air across the engine; a chart is attached which shows a section through the engine compartment and demonstrates the passage of cooling air through the engine and out as warm discharge air.

Removable parts on this trainer are confined to cowl panels and the engine driveshaft.

• **Trainer 5** is real highlight of the en-



Cutaway view showing O-rings. Illustration courtesy Vickers, Inc.

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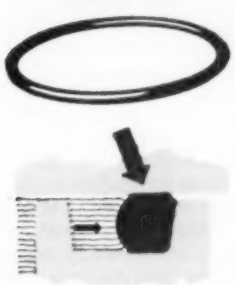

Cross section drawing of O-ring in groove, sealing under pressure.

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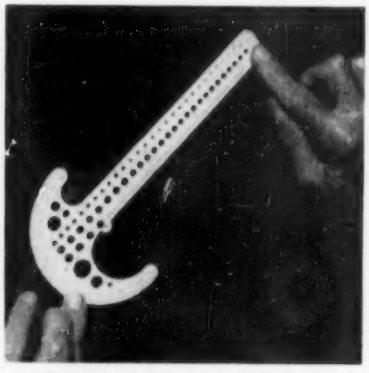
tire setup, the so-called composite transmission, control and rotor system. This trainer most nearly resembles the physical helicopter; it comprises a pilot's seat with full controls, two rotor masts with complete hubs and stub blades, and the necessary transmission shaft and cables connecting all these components.

Power for this stripped-down "helicopter" is a ¾-hp. variable-speed a.c. electric motor coupled by belt to the clutch driveshafts. Speed of the motor is regulated by the collective pitch and throttle mechanism to simulate the engine action.

All the flight controls of the helicopter are exactly simulated in Trainer 5. This feature permits complete checkout of the copter control system by maintenance crews; they can follow a control cable, for example, from the pilot's seat over the various sector arms, around pulleys, into connections with chain link drives or to the control arm itself.

This trainer also incorporates the blade de-phasing feature of the full-scale helicopters. For shipboard storage, helicopter rotor blades are folded. But before this can be done, the blades must be de-phased, that is, one rotor must be moved independently of the other, so that all blades when folded line up over the fuselage. This means that the usual angular position of the



DRAFTING INSTRUMENT

Versatile new drafting instrument combines features of a scale, protractor and template for circular arcs in a single instrument. The semi-circular end is marked in degrees, and the tongue is either an English or metric linear scale. All corners and intersections are curved to radiuses often used by draftsmen for bend radiuses, fillets and such. The holes in the instrument correspond to standard drill sizes, either letter, number or fractional sizes. Circles can be drawn by using the series of small holes along the edge of the scale. The instrument was designed by Gustav Langer, loftsman at Rohr Aircraft Corp., Chula Vista, Calif. Negotiations for its manufacture and distribution are currently under way.

blades must be changed. The system which does this operation is known as a de-phaser.

Sectioning of this transmission trainer is very complete: Both forward and rear rotor transmission units and the clutch are sectionalized, as is a single lag damper on the forward rotor and a flap damper on the rear rotor.

Some liberties have been taken with the actual geometry of the HUP helicopter in order to make the parts adaptable to the trainer. The driveshaft has been shortened, and the rear rotor shaft has also been reduced in height.

Overall height of the unit has been reduced by mounting the rotor as low as possible without hitting the pilot's head. The only drawback is that head clearance is not provided for maintenance personnel who might be standing in the vicinity.

• **Trainer 6,** the last unit, is a small panel which mounts all the special tools required by an entire squadron for maintenance of its normal complement of HUP helicopters.

It is a tribute to the engineering and design of these helicopters that only about 40 of the special tools are required for complete maintenance operations on the HUP. In this group of 40 are included such items as the work platform, jack pads, and blade folding equipment—which are not exactly special tools. Such items as unusual wrenches or pin pullers are kept to a minimum.

► **Mobile Units**—Two HUP trainers have been built and will be used by the Naval Air Mobile Training Detachment as mobile units to visit the different Naval air installations operating Piasecki helicopters. One NAMTD unit will visit East Coast bases and the second trainer will be assigned to the West Coast.

The course at each station will last five weeks, with approximately 200 classroom hours of training. About 30 hours of that time will be spent on electrical systems, including about 15 hours on instruments.

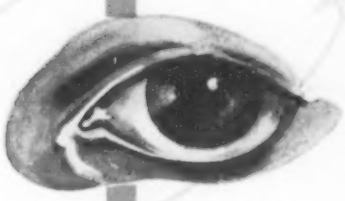
With this collection of animated panels and demonstrators go cabinets containing 100 large charts that diagram such things as electrical systems, lubrication and hydraulic systems and exploded views of components.

Burton-Rodgers designed and constructed this trainer under the direction of Piasecki's service department. Cost of the trainer was about one-third that of a standard production helicopter.

Piasecki's representatives point out that in addition to the direct saving and first cost, there is a continuing saving by using a trainer rather than tying up a helicopter for instructional purposes.

► **USAF Trainer**—A similar maintenance trainer for use by the USAF Mobile Training Group from Chanute

Looking beyond today's horizons



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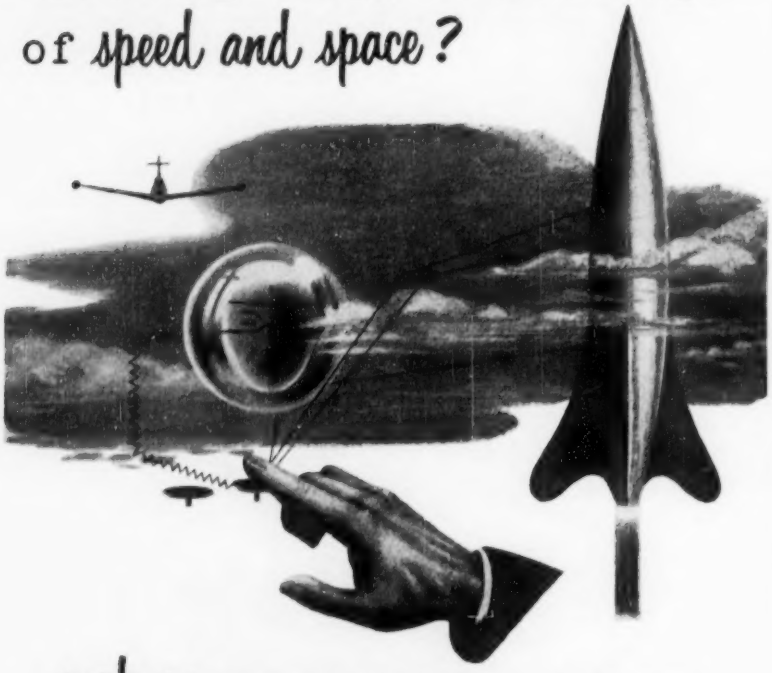

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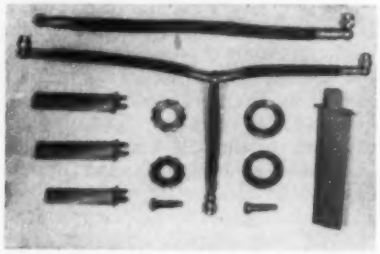
AFB is now being built by Burton-Rodgers for the H-21A helicopter. This also will consist of six basic trainer units.

The first unit will simulate the forward rotor head and the flight control; the second will duplicate the mid-transmission drive; the third will show the engine and engine cooling; the fourth duplicates the hydraulic system; the fifth, the electrical and instrument system; and the sixth, heating and ventilation.

A collection of 34 charts will accompany these H-21 trainer units.



ONLY REJECTED PARTS are four compressor blades, two roller bearings, two oil seals, two flexible fuel lines and two compressor shaft taper bolts as . . .

Rolls-Royce Avons Show 600-Hr. Life

An overhaul life of 600 hours for the Rolls-Royce Avon turbojet has been demonstrated by the Royal Air Force in a 50-day program of flights by three English Electric Canberras.

After 600 hours, engine thrust was still within 3% of the standard figure and specific fuel consumption showed the low increase of 0.11%.

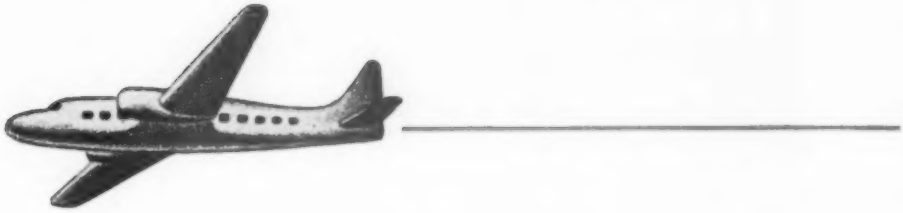
Rolls says that the test "is a unique achievement for an aero-engine of any type and sets a new standard of low-cost maintenance. . . ."

Purpose of the test was to determine the overhaul life of the newest Avons and to provide a datum for RAF requirements of personnel and facilities for maintenance and overhaul.

The three Canberras were based at three different stations. Two of the six engines were stripped at 400 hr. and a third at 450 hr. The stripped condition of these powerplants indicated that it would be possible to fly the remaining three engines right up to the 600-hr. mark.

After that time had been accumulated, the three engines were stripped. Rejected parts were four compressor blades, two roller bearings and two oil seals from the auxiliary drive, two flexible fuel lines and two compressor shaft taper bolts.

The burner cans were only slightly affected, says Rolls, and all have been accepted for a further service life of 400



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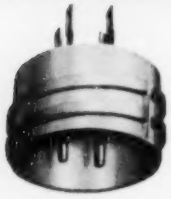


KH

RKH

HERMETIC SEALED Type RKH Plugs and KH Receptacles mate with their corresponding Cannon RK and K standard fittings. The basic construction of fused vitreous insulation around the contacts is same as GS type. Shell materials and finish are likewise similar. Various types of flange or hex-bulkhead styles may be made to order.

Refer to KH-1 Section in K Bulletin.

SUB-MINIATURE receptacles of the new Cannon "U" Series are used on miniature switches, relays, transformers, amplifiers, and other sealed components, requiring a true hermetic seal or a connector of sub-miniature size with performance superiority.

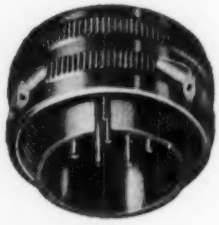
"U" plugs have a steel shell and "SILCAN*" insulator, cable relief and moisture resistant sleeve.

Bayonet-type locking means prevents vibration failure. Rated 1700v. d.c.; 5a. Available in 3, 6, and 12 contact arrangements with one plug style and two receptacles.

**Cannon Electric's special silicone resilient material.*

Refer to U-2 Bulletin

GS02



GS06

GS Types mate with standard AN(MIL) types. These highly successful hermetically sealed plugs (GS06) and receptacles (GS02) pioneered this field and are top quality fittings. Fused vitreous insulation provides a true hermetic seal for relays, position indicators, etc. Shells are steel, finished in cadmium plate and bleached Iridite; coupling nut on plug is natural finish Dural. Eyelet or solder pot terminals.

Built to resist thermal shock, −300°F. to +600°F., surpassing MIL Spec. GS02 Types will withstand operation temperatures 400°F. to 600°F., and pressures as high as 200 to 900 psi; specials to 7500 psi. GS Types approximate AN voltage and current ratings. Wide range of AN layouts available.

See GS-3 section in AN-8 Bulletin for details.

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hours, meaning a 1,000-hour total.

Turnaround time for the planes dropped considerably as the test program developed. During the first month, about one and one-half hours was a typical figure, but by the third month of the tests, the time had dropped to 36 minutes.

Peak utilization of the aircraft was 73 flight hours out of 84 total elapsed hours.

For some of the flights, runways were either sanded or salted because of weather, and this worried test personnel because of the possible corrosive effects on airframe and engine. At the 450-hr. mark there was no sign of corrosion by salt.

Rolls points out that during the test period, each engine covered a distance of about 300,000 miles before overhaul. This compares to a figure of 100,000 mile for locomotives or commercial road vehicles in England, says Rolls.

ASME Sets up Lube Study Group

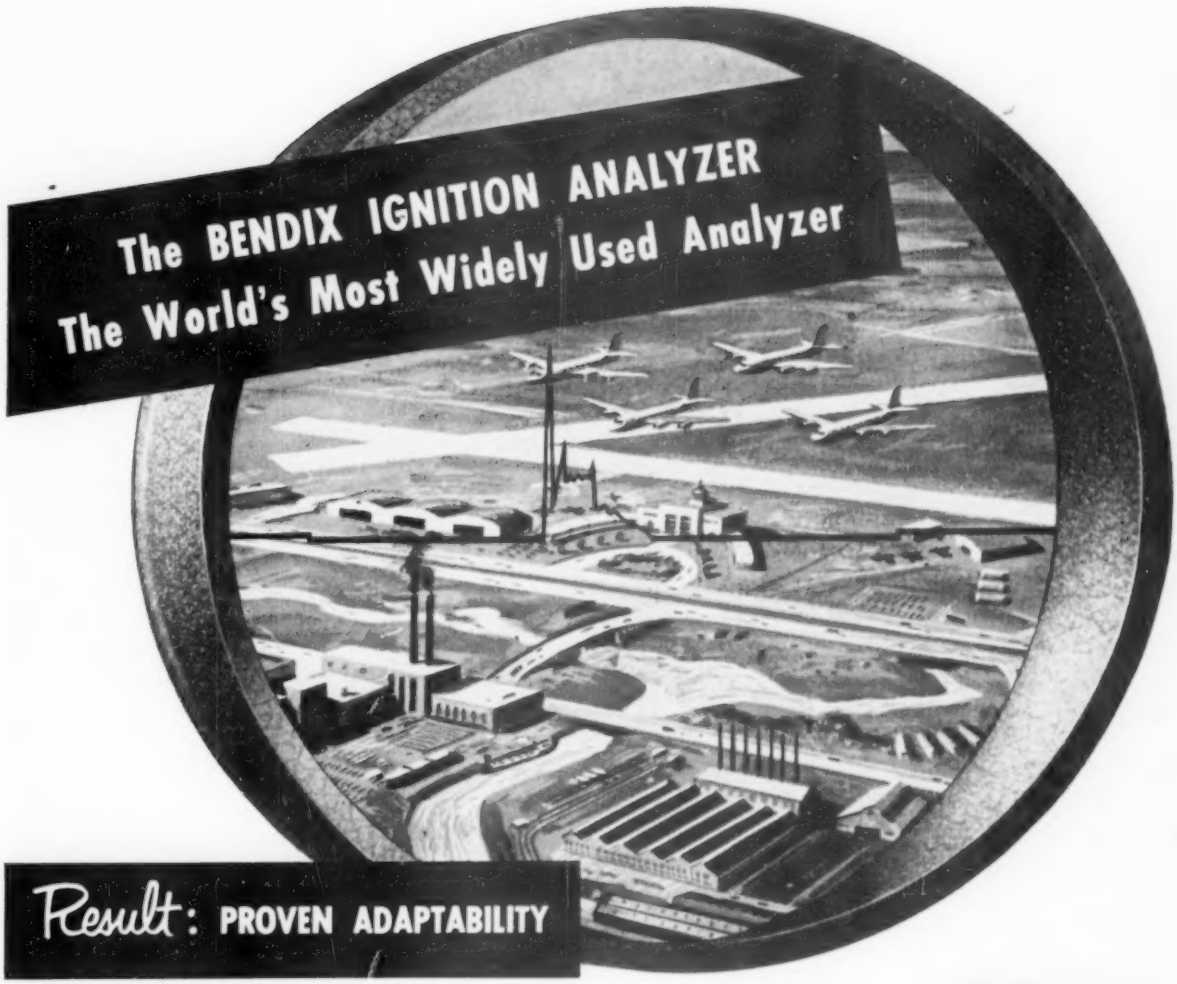
A Lubrication Activity group has been set up in the American Society of Mechanical Engineers to function as a subcommittee reporting to the society's Professional Divisions Committee.

Initiated as an experimental undertaking, the Lubrication Activity will embody these study groupings and efforts:

- **Research.** Theories of lubrication, mathematical treatments of design, boundary and fluid film investigations, etc.
- **Lubricants.** Physical properties and action of lubes.
- **Builders.** Factors such as reservoir design, seals, systems, methods of starting new machines, and maintenance related to construction.
- **Operators.** Maintenance practice, overhaul and repair, lubrication personnel.
- **Coordination.** Liaison for coordinating the new activity with professional divisions and other engineering societies, arrangement for co-sponsorship of papers on lubrication.
- **Application.** Methods and equipment considerations. This group is not yet active, but is being organized.

▶ **Projects Underway**—A number of projects already are starting. These include catalytic effect of materials on lubricants, effect of lubes on metals, study of proper paints for treatment of metal surfaces subjected to oil, coordination of lube design data, fretting corrosion, etc.

Liaison already has been set up with the American Society for Testing Materials and American Society of Lubrication Engineers. The Lubrication Ac-



IN USE BY INDUSTRY, THE MILITARY, and COMMERCIAL AIR LINES

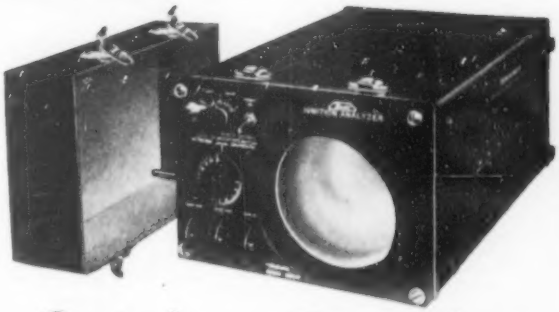
The universal acceptance of the Bendix Ignition Analyzer is perhaps the most conclusive evidence of its ability to reveal the performance of ignition systems wherever they are in use.

Airborne or used for ground overhaul, operated in arctic or tropical temperature, on long flights or short hops, the Bendix Ignition Analyzer unfailingly predicts the remaining life of individual spark plugs and checks in advance the efficiency of all ignition units.

Such proven adaptability means that air line operators can keep a constant accurate check on the efficiency of their ignition systems. It means further maintained schedules and overhaul expenses materially reduced.

It is hardly an exaggeration to state that no other single piece of equipment pays such big dividends in engine operating efficiency and maximum safety as does the Bendix Ignition Analyzer.

Detailed literature on request.



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The Bendix Ignition Analyzer is available for either airborne or portable-airborne installations. It can be used with either high or low tension magneto or battery ignition. It is the ignition analyzer that can predict spark plug failure before it occurs . . . make an efficient check of more than one spark plug at a time and do so on a large, easy to read screen . . . yet it costs less than comparable analyzers.

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tivity has registered about 150 men interested in becoming active members.

Inquiries are invited from any ASME member who wants to join in the work, designating the one or two groups in which he is interested. Address is 29 W. 39th St., New York.

MIT Schedules Light Metal Talks

A special program designed to unravel problems and promote information on light metal castings is being sponsored by Massachussetts Institute of Technology, during the coming summer session of the school. It will run from Aug. 31 to Sept. 4.

The program will include consideration of the principal light metals—aluminum, magnesium and titanium—with one day being given to titanium.

Because an important objective of the program will be to encourage free discussion of the problems, no abstracts will be prepared either before or after the conference. Topics will include gating and risering, fluid flow, shrinkage and mechanisms of solidification, heat transfer, gases in light metals, influence of cast microstructure on mechanical properties, casting design, grain-size control, inspection and repair.

Additional data on the program and application blanks may be obtained from Director of the Summer Session, Room 3-107, Massachussetts Institute of Technology, Cambridge 39. Mass.

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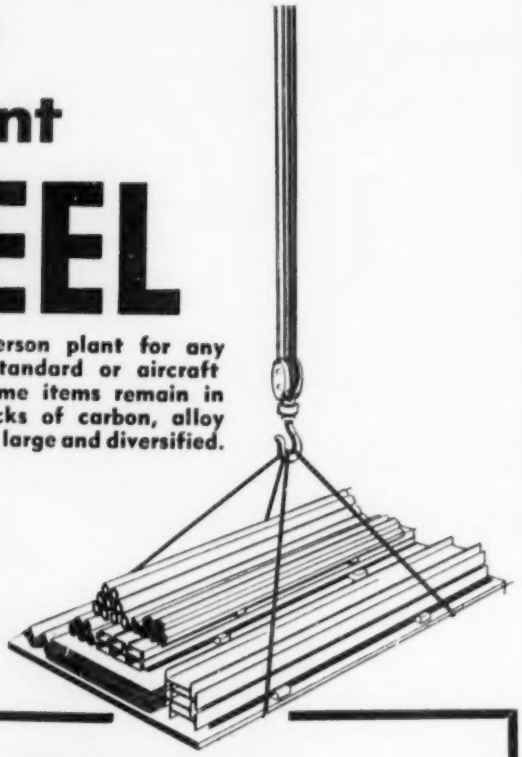

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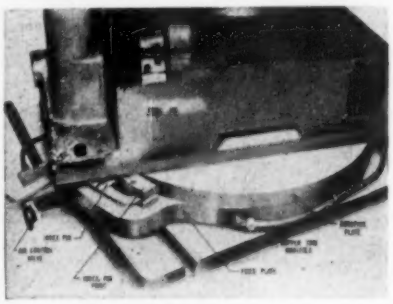


Air Bearing Smooths Drill Jig Positioning

Compressed air is being put to work at Solar Aircraft Co., to do the job of a thrust bearing in a heavy machine tool, easing the effort required of the operator. This is particularly helpful where female production workers are employed.

Solar's "air thrust bearing" is used on the index table for a drill jig on a Natco multiple spindle unit. The air manifold is connected to a manually operated control valve. Manifold tees located radially around the machine's fixed base plate lead the air into the space between the fixed plate and the heavy rotating plate about it.

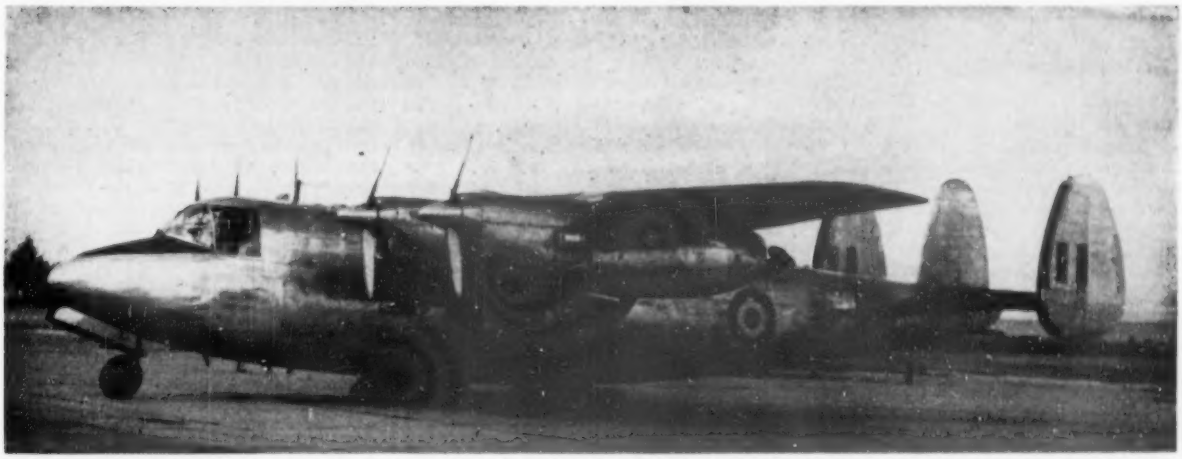
▶ **Advantages**—Solar reports that the cost of providing an air bearing is much less than for a conventional thrust bearing, especially when jigs are large and heavy. And because the friction coefficient is lower, the rotating plate can be turned easily. Since the plates are slightly separated during movement, wear is reduced.

▶ **Air Lift**—Air at 90 psi. is fed to the manifold by opening the control valve, raising the rotating plate about .005 in. The rotating plate is moved to the next index point and the air valve is closed. The air in the system escapes and the rotating plate settles on the base plate to give a solid support for the next drilling operation.

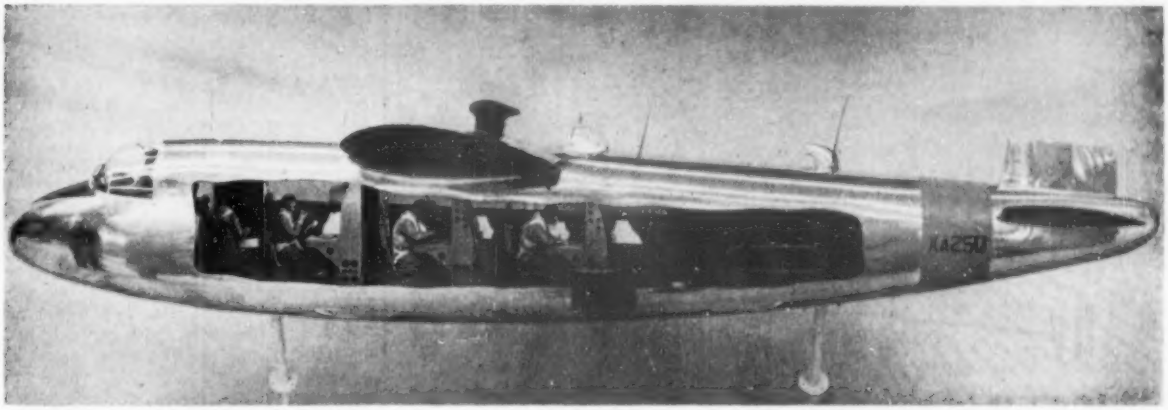
In tools of this type, the plates are usually machined and have minute grooves through which the air can travel. This gives an effective lifting area equal to that of the base plate's face. Because the air escaping is at about 45 psi., the difference between this and the entering pressure gives an effective pressure of 45 psi. on the area between the plates.

The contact area between the plates must be protected against chips. This can be done by providing felt wipers to seal the joint at the plates.

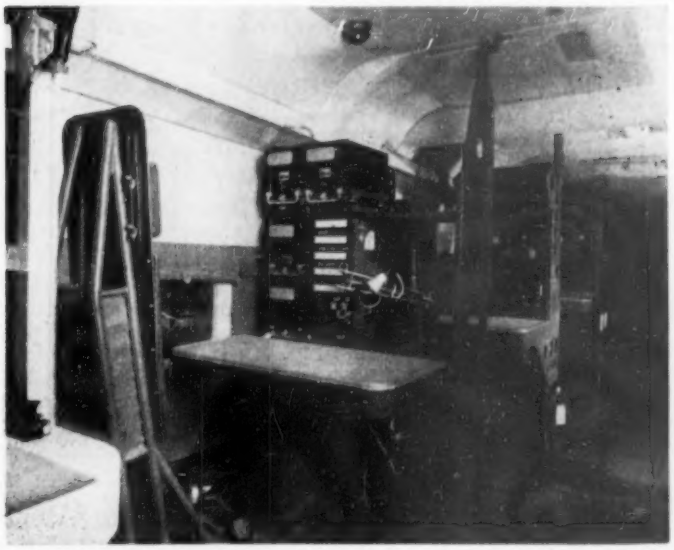
RAF Getting New Navigation Trainers



MARATHON T.2 is navigation trainer being delivered to Royal Air Force by Handley Page, Ltd. The plane is powered by four 340-hp. de Havilland Gipsy Queens and has a 1,400-mi. range. RAF is getting 30 of the T.2s.



MODEL of the Marathon shows interior arrangements: Positions, from front to back, are radio operator (seated sidewise), instructor, two pupils. The trainers carry Rebecca Mk. 4 and Gee navigation equipment.



INSTRUCTOR layout is in foreground (actual plane pictured here). His seat faces rearward, as do the . . .

PUPIL navigator stations. The T.2 Marathon is designed for basic and advanced training.

LETTERS

Howard Challenged

The article by Ben O. Howard on which Alexander McSurely reported in your Mar. 23 issue has left many flight engineers, including the writer, slightly nauseated. It is of slight surprise to us that the Institute of the Aeronautical Sciences asked Mr. Howard to withdraw the paper before it was presented. The IAS is representative of a good cross-section of the sincere group of men who devote their energies to this aviation industry.

Our first impression of the article was that it was of the type which when ignored just fades into obscurity. However, some people in this industry feel that the honest, brilliant efforts of hundreds of thousands of engineers, scientists, pilots, designers, etc., who have produced the world's best and safest aircraft must be upheld in the face of undeserved slander. We would like to rise to the defense of aviation!

Today we are at a state in the development of the art of aviation which carries more people farther in greater safety, regularity and comfort than ever before. No one is satisfied with our safety record but we are all constantly working to improve it. Mr. Howard's search for a new index upon which to base airline safety is almost humorous.

Certainly! If you could carry all of our present air travelers in DC-3s over high terrain, at high speeds, over weather, long range, you might have a basis for comparison with our modern aircraft.

However, the facts of life are that the DC-3 will not provide such transportation. We had to develop large, fast aircraft to do the job of modern air transportation demanded by our national defense and progressive domestic economy. To accomplish their purposes these large aircraft had to have the many new devices to perform fast, high-altitude flight. Thus fitted, the aircraft are necessarily a more complex machine and due to their size there is a lot more of the complex machine. These are facts with which we must deal. We cannot ignore this change and attempt to equate present safety standards against zero when we have a solid past for comparison.

Nobody in this industry willingly tolerates crashes as charged by Mr. Howard. After participating in many accident investigations, airworthiness regulations reviews and similar drives on aviation safety to get at basic causes, we are convinced that the best brains and common sense of this industry are pitted in the fight for ever-increasing safety.

Mr. Howard's charges make a mockery of the CAA, CAB, NACA and the many organizations who watchdog every phase of aviation. Their sincerity is not at question. We have never doubted Mr. Howard's sincerity in his approach to the common problem; but at best we can only credit him with a mighty small minority opinion.

Many people misinterpreted Mr. Howard's statement concerning the safety level of an aircraft which ". . . requires the assistance of a flight engineer or third crew member."

The facts are that our modern large aircraft **do** require such assistance in their management. With this fact well established, Mr. Howard is doing the industry a disservice by implying that these present aircraft could be flown more safely with a crew of two or one. At least one airline president so interpreted the statement and took steps to modify his operation as though his airplanes were some of Mr. Howard's dreamboats of the air.

Let Mr. Howard fly coast-to-coast in the old crates. The other 99.9% of us will go in modern comfort, safety and style in the products of the world's finest corps of transportation genius—The American Aviation Industry.

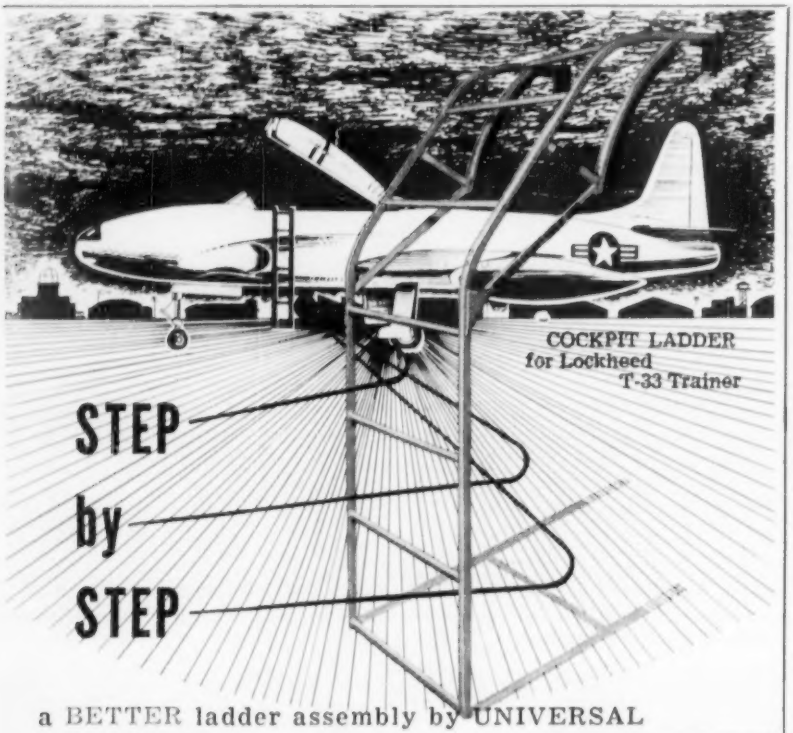
William D. Kent, President
Flight Engineers' International Assn.
32 Third Ave., Suite One
Mineola, L. I., N. Y.

Those F6F Drones

This letter is provoked by the comments on the drones used in Korea, contained in the article "Missile Program Still Lags Dangerously," by David A. Anderton, in your Mar. 2 issue.

While not presuming to be capable of commenting on the condition of the missile program and assuming for purposes of this letter that your portrayal in Aviation Week on Mar. 2 is reasonably accurate, I wish to put in a plug for that lowly but practical and available "assault drone."

There is bound to be a "loss of face" among missile promoters when the "ob-



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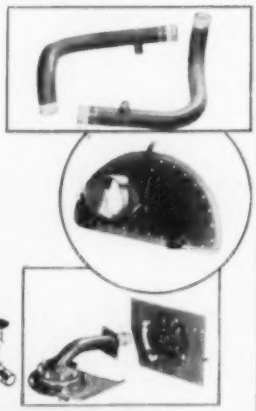

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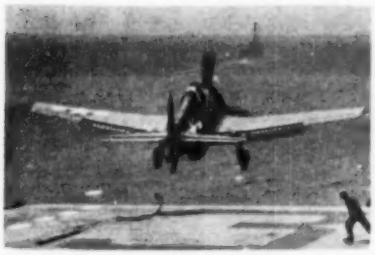


solete" drone, which has been a minor effort proposition with little development, is used successfully in a field allocated to mystery and expense.

It is always disconcerting to learn that something you already have can be used for something you are buying. This is especially so when you have invested considerable money and find that the something you have costs practically nothing. I think, therefore, that the extremely adverse criticism of the use of the F6F drones in Korea has been unfortunate. Now, missiles we must have, and if there are difficulties we must surmount them.

But—we did not slur at the bayonet when gunpowder was invented, and that much-assailed assault drone could be as useful today or some day as the Russian mule was against German mechanized forces. Unless it is the intention of the missile promoters to completely replace the piloted aircraft, there will always be types of costly aircraft that rapidly become obsolete for piloted combat (the F-84 shot down by the Czechs may be an example). . . .

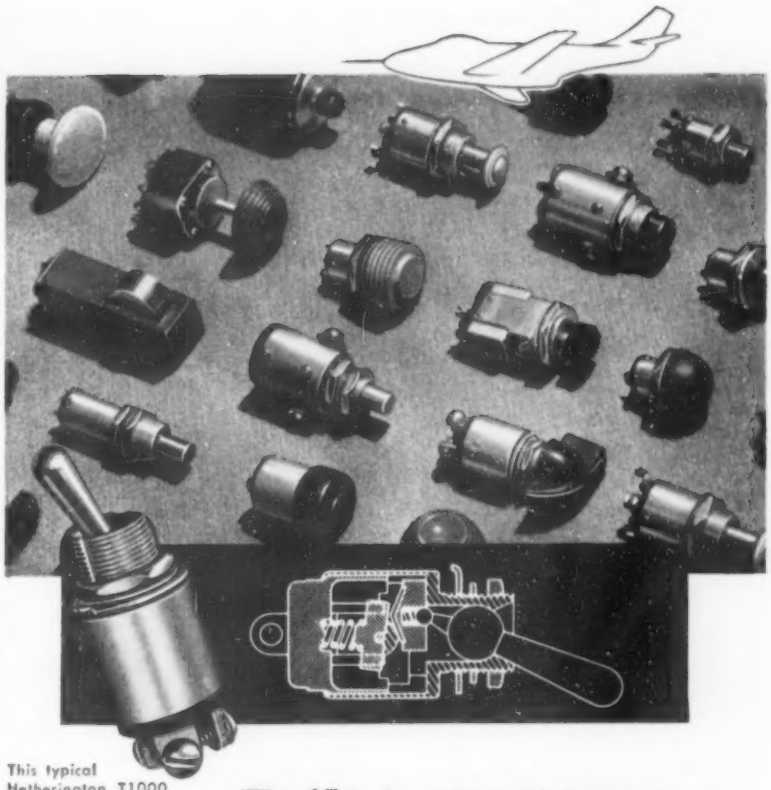
It may be wiser to support those bright lights in the service who see an opportunity of obtaining some use for older aircraft types, obtaining thereby a better return for the defense dollar. This is a rare thing.

Aside from the economic picture and assuming your description valid, the assault drone constitutes one of the few available ground-to-ground or air-to-ground missiles, if not the only one. However, back to the economics: with all missile programs 100% successful, we cannot afford to throw away, with a feeling of contempt, another useful weapon. With all of the slurs directed at the assault drone, it would not fall far short of missile performance for many applications after a little more effort on equipment and training.

It is interesting to note that several of the (ground-to-ground) missiles referred to in your article as promising are by your description hardly more than assault drones with the pilot's seat omitted. It is good that these projects are successful, but why not also use aircraft that are modern but are rendered inadequate for piloted combat by the fast pace of military piloted aircraft development?

There has been very little development in this field since the war, when the crude beginning was made. However, the techniques are well developed in comparison to missiles, and the developments required to make the assault drone an adequate weapon could be accomplished for what would be considered "minor costs" to a missile project. It took considerable courage and conviction to use these much-neglected devices as weapons before the eyes and criticism of the world.

While the men devoted to missiles to the



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Avien Introduces its "Two-Unit" Fuel Gage

This "repackaging" of Avien's capacitance-type fuel gage is 50% lighter and needs no field adjusting

Ever since Avien developed its capacitance-type fuel gage, our engineers have stuck to the task of reducing the system to its simplest form.

Now they've done it, with the Avien Two-Unit Fuel Gage.

Basically, it is the same sharply accurate system that Avien has designed and which has been installed on thousands of modern planes. The big news is in the "package"—for the necessary components have been reduced to a sensing unit and an indicating unit.

Avien has buried the "black box"

Up until now, most fuel gaging systems needed four units; a tank unit, an indicator, a bridge-amplifier, and a shock-mount to guard it against vibration.

No field calibration was required for the Avien tank unit or indicator. Avien held them to such close tolerances, the adjustments for individual installations were actually "built in."

The bridge-amplifier (the "black box") was a different story. This intermediate unit was supplied as a common part, for universal application. And that's where field calibration *had* to be made.

The rigid specs for the bridge-amplifier component have previously held back improvements in the system as to weight, size, cost, performance and flexibility. There was only one answer, as far as Avien was concerned. The "black box" had to go.

In the Avien Two-Unit system, the necessary components for the bridge and amplifier functions have been built into the indicator case. The "black box" is eliminated, and so are certain components which were necessary to make the "black box" universally applicable.

No more field adjustments

The Two-Unit Fuel Gage gets installation down to "plug-in, plug-out" simplicity.

The Avien tank unit and indicator are pre-calibrated for the aircraft they are designed for. Since the intermediate unit is not needed, neither is field calibration.

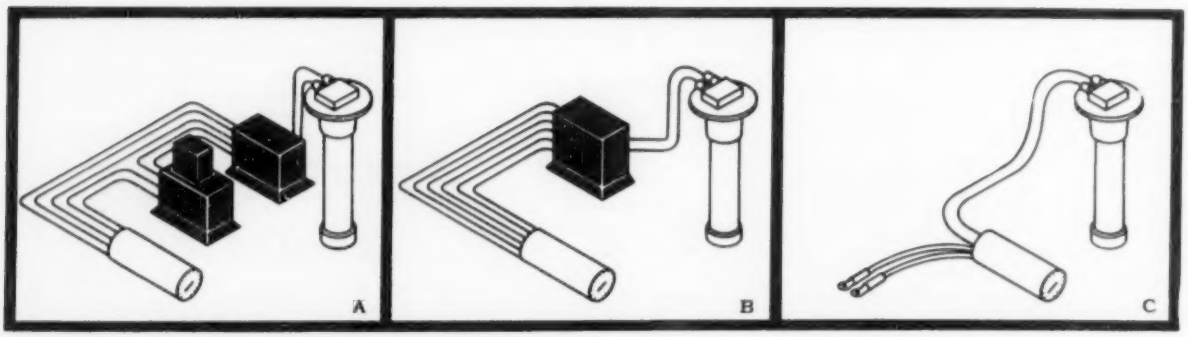
Since no calibration is required, all units designed for the same aircraft are interchangeable. Avien units are now all "shelf items."

The Two-Unit Gage eliminates three drawbacks of field calibration:

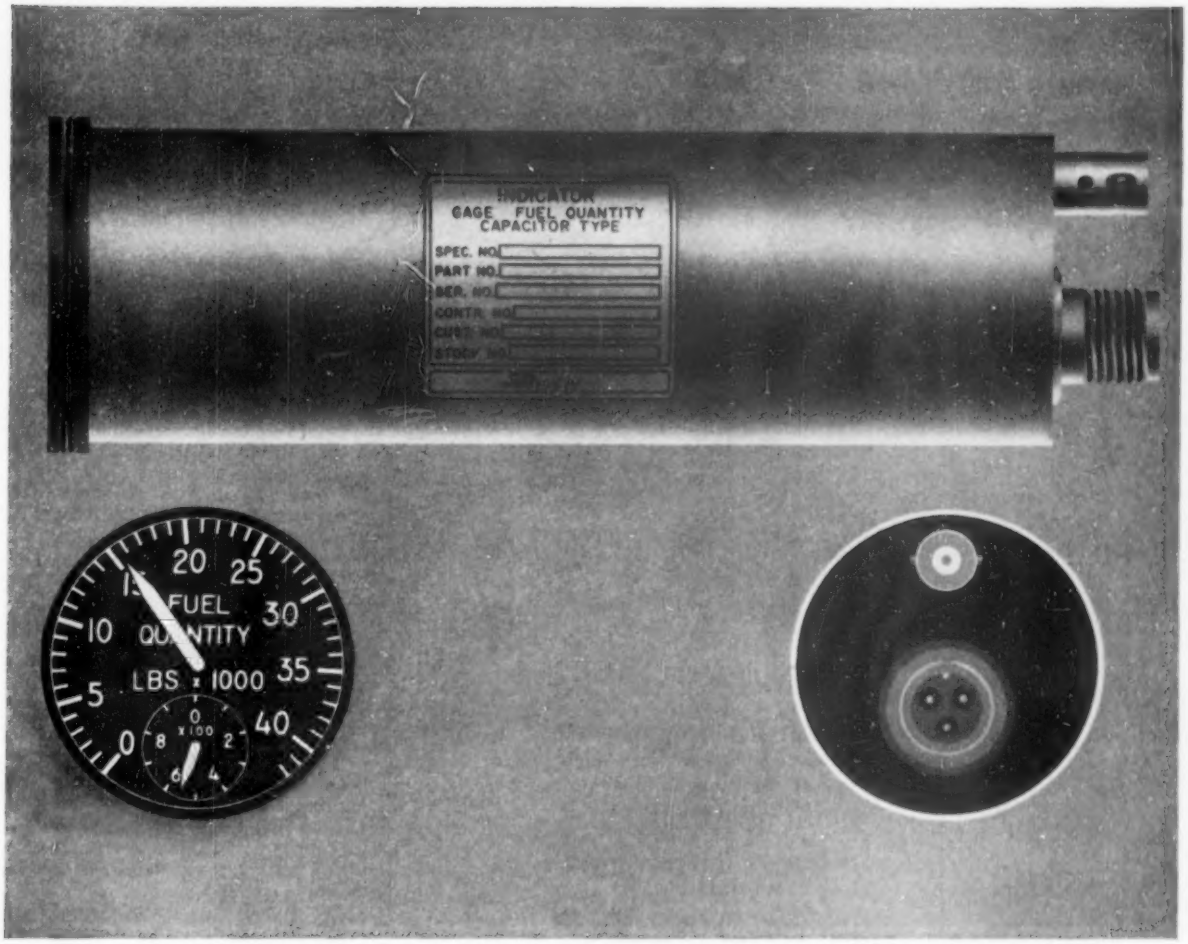
1. *No trained personnel needed.* To err is human, but human fallibility is built *out* of the Two-Unit Gage.

2. *No specialized test equipment needed.* No precision condensers, bridges or calibration boxes required.

3. *No calibration instruction or data needed.* Have you ever run this "paper chase"? By the time you've tracked the information down, it's often obsolete. No more of that!



Fuel gaging progress: Early gaging system (A) had four units. The 1952 system (B) incorporated bridge and amplifier into a single unit, reduced weight almost 15%. Avien's Two-Unit Fuel Gage, now being introduced (C) repackages the system with further miniaturization of components, this time reducing weight by 50%.



Full scale drawing of Avien's Two-Unit Fuel Gage: Front, side and back views of the small-size indicator-amplifier unit. "Plug-in, plug-out" simplicity is the keynote.

Savings all along the line

Simplification means less weight. In the Two-Unit Fuel Gage, the basic system is reduced in weight by 50%.

There are cost savings, too. Less time is spent in installing the Two-Unit Gage. Less wiring and connectors are needed. Less maintenance is required, because there are fewer components to maintain. Trouble-shooting becomes easier, because there are fewer units to cause trouble. And fewer parts must be stocked for replacement and repairs.

Fuel gaging AND fuel management

Avien's Two-Unit system retains an important feature of the former gage. Additional functions for fuel management can be integrated into the basic gage.

This means that simulators, level switches, balancing controls, totalizing equipment, etc., can be hooked up to the basic system – and with even less difficulty.

Another interesting aspect is that the Two-Unit Gage is designed to take advantage of recent improvements in mechanical and electronic design – the new lightweight coaxial cable, the new miniature A N connectors, and Avien's new lightweight tank units.

Now scheduled for production

The Avien Two-Unit Fuel Gage is now available to meet your manufacturing schedules.

The indicator is available in either large or small sizes, with all varieties of dial configurations.

Every month, Avien produces over ten thousand major instrument components for the aviation industry.

We believe that Avien's Two-Unit Gage will contribute to the obsolescence of many earlier systems, including our own.

For further information write or call us.

Avien

AVIATION ENGINEERING DIVISION

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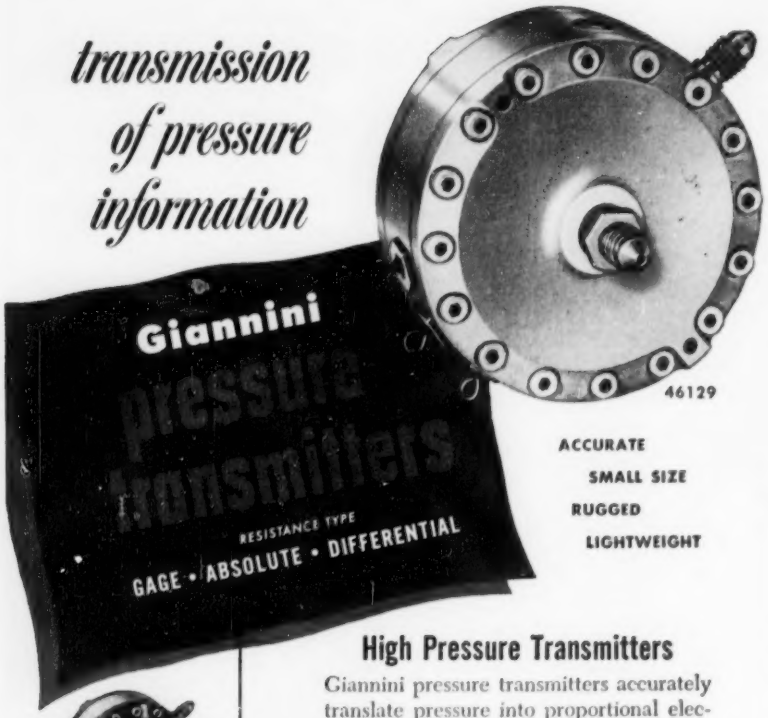
transmission of pressure information



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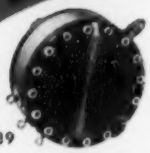
High Pressure Transmitters

Giannini pressure transmitters accurately translate pressure into proportional electrical signals of relatively high power—signals, that require little or no amplification for utilization. These high pressure transmitters incorporate a unique, direct-coupling arrangement between bourdon tube and potentiometer element which obtains movement amplification without the use of gearing or linkage, thus giving high sensitivity, repeatability, and low hysteresis. Specific models are available for operation under either normal or extreme conditions of vibration and acceleration.

Models also available for low pressure and high altitude applications.


46139

46118

46119

MODEL	WEIGHT	GAGE	ABSOLUTE	DIFFERENTIAL
* 46129	0.75 lbs.	0-100 psig up to 0-600 psig	15-100 psia up to 15-600 psia	0-100 psid up to 0-600 psid
46118	0.3 lbs.	0-100 psig up to 0-6500 psig	0-100 psia up to 0-500 psia	0-100 psid up to 0-600 psid
* 46119	0.6 lbs.	0-100 psig up to 0-6000 psig	0-100 psia to 0-600 psia	0-100 psid to 0-600 psid
46139	0.75 lbs.	0-100 psig up to 0-6500 psig	NONE	NONE

Standard Resistance 2,000 ohms. * For Corrosive Media.
For specific values of linearities, resolution, repeatability and hysteresis, write for bulletins.

Giannini INSTRUMENTS CONTROLS

G. M. GIANNINI & CO., INC. PASADENA 1, CALIF. EAST ORANGE, NEW JERSEY

exclusion of other weapons are very ready to point out any shortcomings of the assault drone when compared with anticipated missile results, I would like to list a few of the advantages of the obsolete drone:

- They provide a use for aircraft that are no longer efficient for piloted combat. It would seem that their final use as assault drones would be wise, expedient, and economical—an unusually happy combination.
- Airframes and powerplants are reliable—all have had the benefit of service life for piloted operation. What better guarantee could there be of airframe and powerplant reliability?
- Stabilization and guidance problems are not as severe as in the case of missiles.
- Low cost when compared to missiles—since an assault drone program would fall heir to the aircraft after service life, the cost of the airframe and powerplant would be practically nil in comparison with missiles.
- Performance. It would appear from the newspaper report that the F6F drones accomplished a task in Korea. With a little more effort, assault drones may accomplish more difficult tasks; and at any rate in their present "obsolete" condition are more efficient than the non-existent or unavailable missiles referred to in your article.
- Minimum transportation problem. In many cases they could be flown to the combat area by human pilots, and at most their transportation presents no greater problem than that of fighter aircraft.
- Can be flight tested by human pilot prior to use—quite an advantage over the missile that does not fly but once.
- Standard fuel. The fuel is the same as that for piloted aircraft. It is available when needed, and its transportation presents no unusual hazard or expense.
- Maintenance. In general, drones use standard aircraft parts, and service personnel trained in piloted aircraft are certainly familiar with them.
- No unusual launching facilities. Drones may be launched from any strip or carrier that is usable by piloted aircraft.
- Kamikaze-minus-one. The Kamikaze was admittedly an effective missile. The assault drone offers the same performance without the expenditure of human life.

While not advocating at all any let-up in missile efforts, and expressing sympathy for those contending with its trying problems, I think there should be additional consideration given to assault drones.

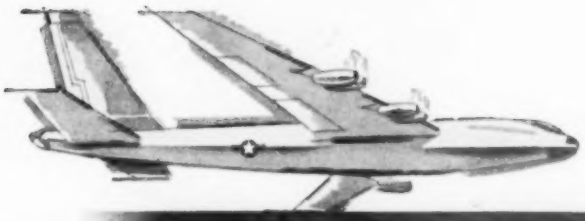
Robert B. Eaves, President
Spin Engineering & Development, Inc.
Paxson & South Aves.
Wyncote, Pa.

Robson's Right

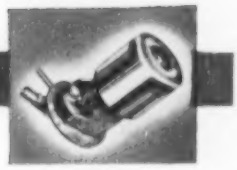
Please pass this on to Capt. Robson to let him know he has a friend. I agree with everything he wrote ("Pilots and Those AF Crashes," Feb. 23). When the hot heads cool off enough to get a reasonable perspective some of them might get the picture (though that is questionable). Would like to ask some of them if they'd let their wives and children ride in military transports. I certainly would not.

Wish I had time to write a four-pager supporting Robson's views but am confident he can take care of himself.

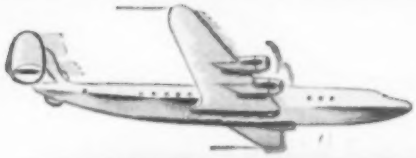
Jack Hoyt
7943 South Kilpatrick Ave.
Chicago 29, Ill.



EVERY TYPE OF PLANE . . . IN



EVERY TYPE OF SERVICE



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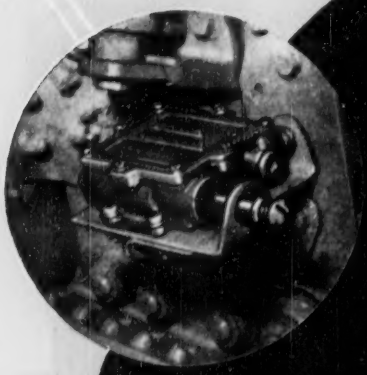
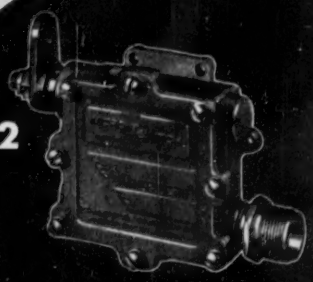
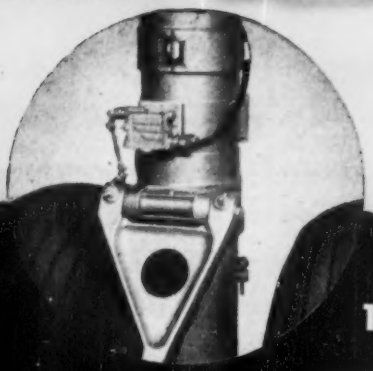
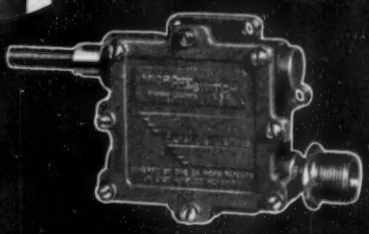
Why modern aircraft designers look first to MICRO for small, precise lightweight switch assemblies

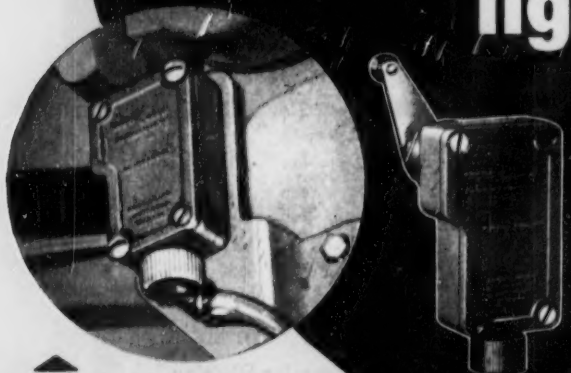






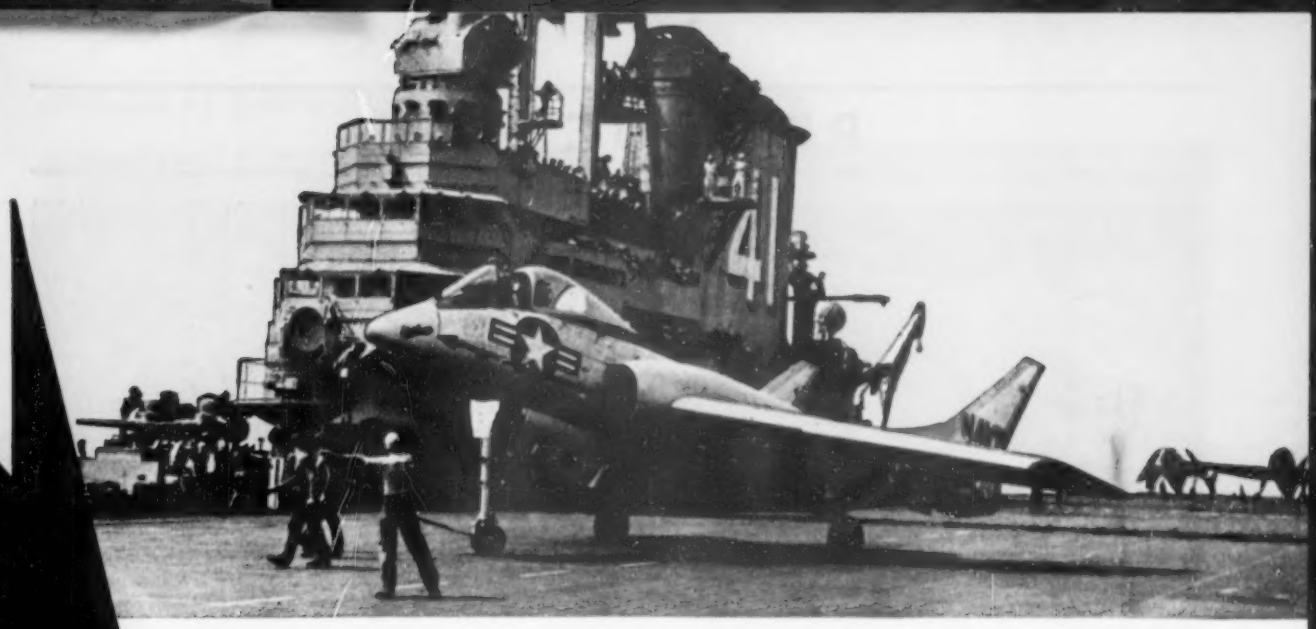


• Two applications of **MICRO** "LA" switch assemblies, sealed for use in exposed locations. (1) On main landing gear scissors of Martin 404 and (2) as a landing gear uplock switch to signal pilot when landing gear of Chance Vought's Cutlass is retracted and locked.



• **MICRO** "VA" Switch assembly installed on Chance Vought's Navy Cutlass to signal pilot when the landing gear is extended and locked in position.

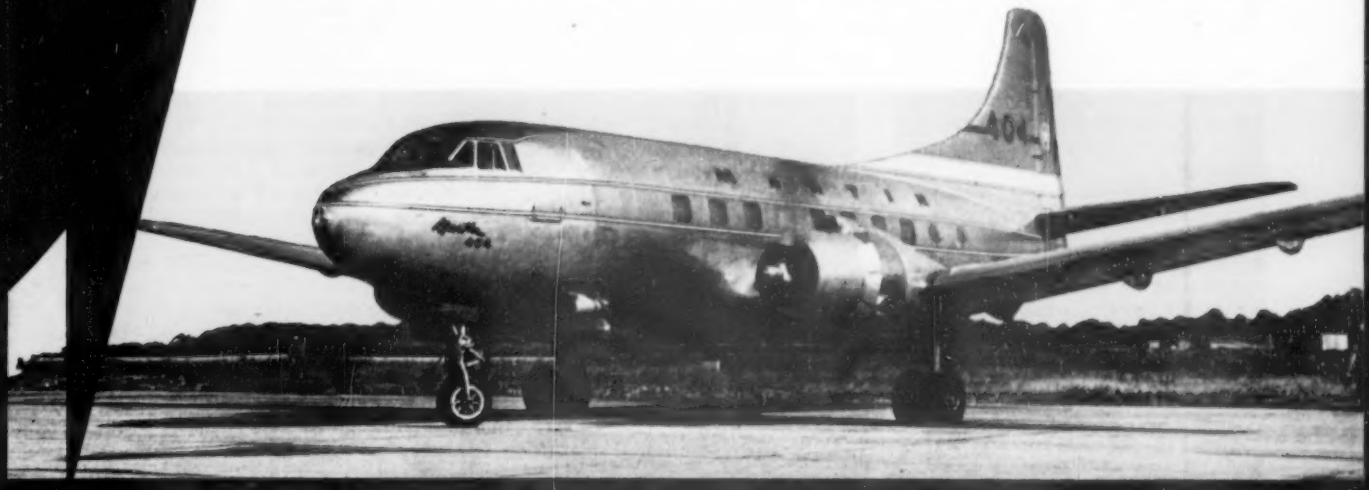
• **MICRO** "LMR" Switch assembly installed on the main gear strut extension of Chance Vought's Navy Cutlass which locks the landing gear to provide against accidental retraction when the ship is on the ground or carrier deck.



MICRO "grew up" with the aircraft industry as we know it today. Hundreds of MICRO switches have been designed and built to fill aircraft needs for components that combine small size, light weight, high capacity and complete dependability . . . and are unaffected by changes in environmental conditions.

Hardly a plane flies in America today that does not have from two to hundreds of MICRO switches as safeties, limits and controls for complex electrical circuits. Two of them are illustrated here; Chance Vought's Navy F7U-3 Cutlass (above) and Glen L. Martin's 404 passenger liner.

The switches shown are but four of innumerable switches developed in close cooperation between MICRO engineers and aircraft designers. There are always new switches being developed at MICRO. That is the reason aircraft designers save time and money when they bring their switch problems to MICRO first.



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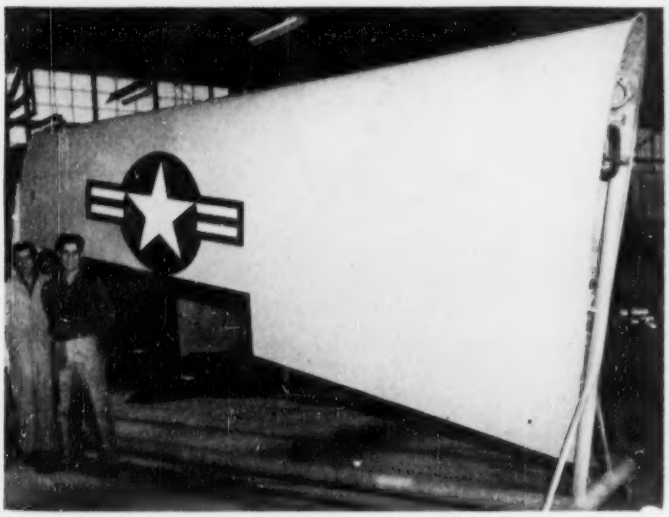
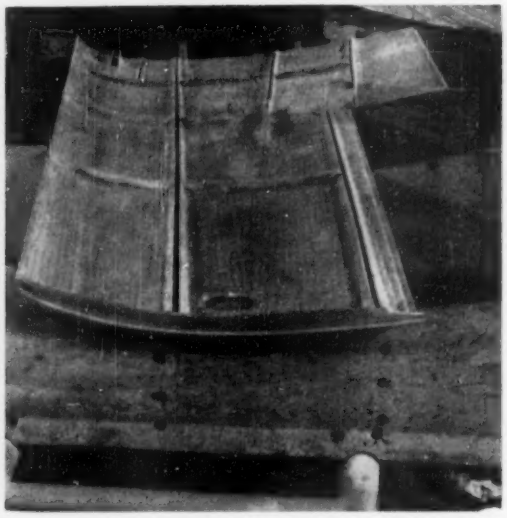


OUTER WING PANEL of AT-6C shows smooth, high-gloss finish of glass-plastic material. Root end carries metal match-angle for panel attachment to wing's metal center section. Metal aileron and plastic wingtip are still to be fitted on panel shown.



UPPER HALF SANDWICH of right wing panel seen from inside shows tip rib, internal formers, and gussets providing slots to receive various beam members.

First Detailed Report on . . .

How Glass-Plastic Wing Is Fabricated

By Irving Stone

The spadework to prepare reinforced plastics for big jobs in tomorrow's high-speed aircraft is well under way. Plans and projects in the works will pave the way for a wide use of these plastics in planes, missiles and auxiliary components.

The studies aim to take advantage of such properties of this type of materials as their favorable strength/weight ratio, low coefficient of expansion, good flexibility characteristics and aerodynamic smoothness.

In this article, fabrication details for aircraft structures of plastics are given for the first time.

▶ **Proving Effort**—One of the earliest applications of high-strength plastics—a role that practically launched the material into the field of primary structures—is a glass-plastic outer wing panel which has been under flight evaluation for several months at Wright Air Development Center, Dayton, Ohio.

This wing has been flying on a North American AT-6C (first details of the project were published in AVIATION WEEK Mar. 2) It is a development still far from perfection as far as supersonic aircraft are concerned. But it is a concrete beginning.

Prime purpose of the development was to establish factors of design for low-pressure, reinforced-plastic laminates in aircraft structures. A wing represents a highly stressed major structure, so it was felt the outer wing panel on the AT-6C would be a proving article for determining the suitability of plastic makeup for a complete plane.

Another goal was simplified design incorporating sandwich construction. In the final configuration of this glass-plastic wing, there are relatively few structural parts in comparison with the numerous bits and pieces of the conventional metal panel.

▶ **Know-How Advances**—The wing was an experimental project. Though its final weight was somewhat above that of the metal counterpart, its strength-weight ratio was slightly greater.

Because it was a "ground floor" effort, the project spanned a considerable period from inception of design to delivery of the flight article. In the meantime, the art of designing for and working with reinforced plastics has progressed considerably. If this same AT-6C wing project were to be initiated today, a lighter, more efficient structure undoubtedly would result through various refinements in techniques and materials now available.

▶ **Work at Wright**—The AT-6C glass-plastic wing design was begun early in 1944 in the Engineering Division of the Air Materiel Command's Aircraft Laboratory. This activity now is under the ARDC's Wright Air Development Center.

Three experimental articles were built in the Engineering Shops Laboratory in 1945-46. Static tests of the third panel were concluded during 1946.

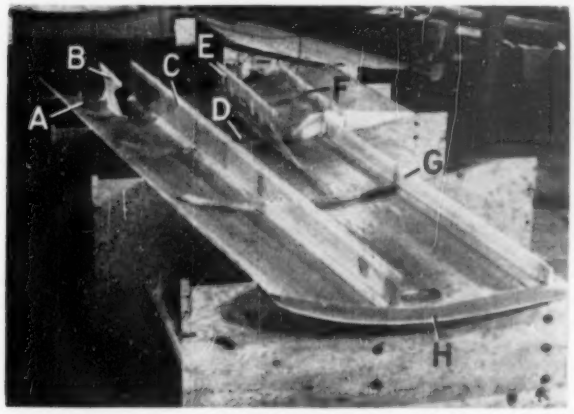
▶ **Flight Article**—In July 1947, East Coast Aeronautics, Inc., Pelham Manor, N. Y., now a subsidiary of Barium Steel Corp., was awarded a contract to build right- and left-hand wing panels for service test, plus an additional panel for further static proving.

Under this contract, ECA was to construct the wing panels in accordance with AMC's engineering drawings. But as the project progressed, ECA suggested design changes which led to the configuration now flying.

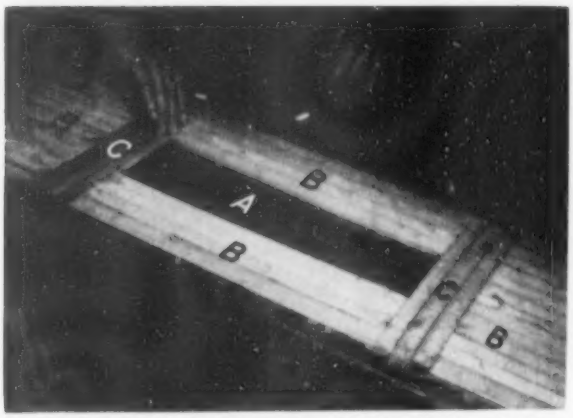
The static test article was delivered to the Aircraft Laboratory in November 1950. This right-hand outer panel went to about 140% of ultimate design load in the critical condition (positive high angle of attack).

The flight panels were delivered in February 1952. They were later installed and flown on the AT-6C at

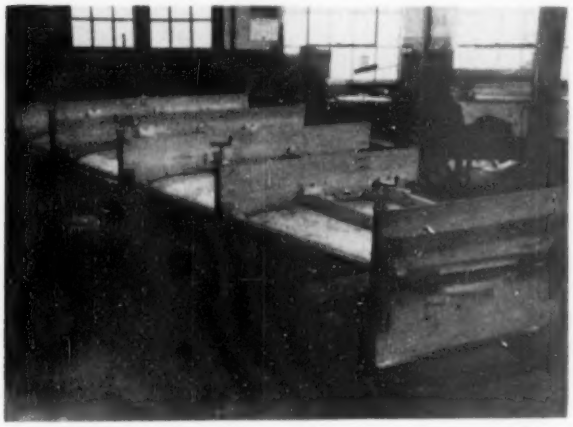
Details of Glass-Plastic Wing Manufacture



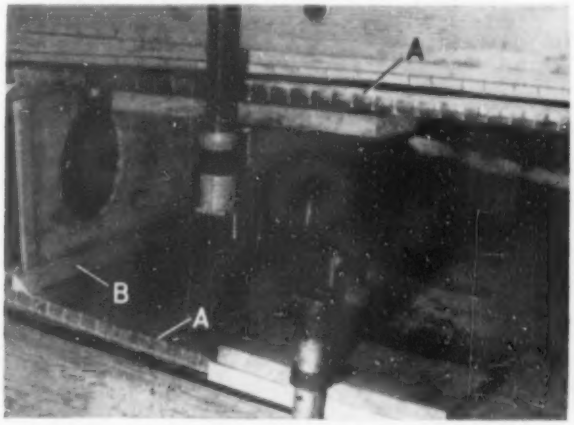
INTERNAL STRUCTURE of skin sandwich is shown in place. Parts are (A) landing gear strut fitting, (B) jackpad beam, (C) main beam, (D) aileron quadrant fitting, (E) intermediate beam, (F) flap beam, (G) aileron beam, (H) tip rib.



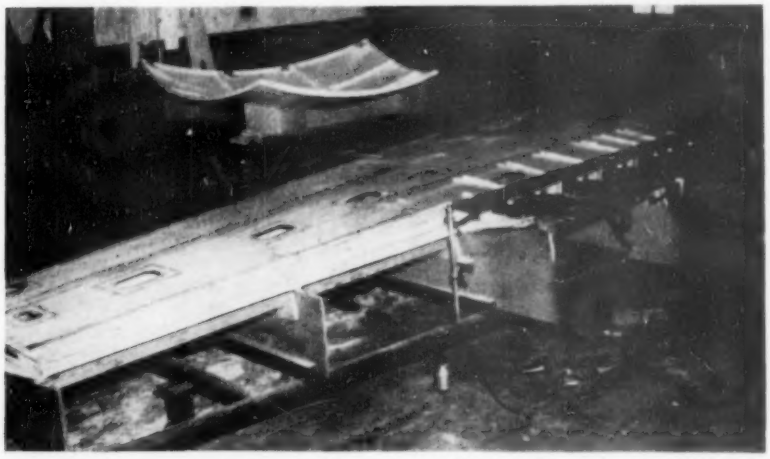
LAYUP for East Coast Aeronautics-built AT-6C main beam core shows (A) glass-cloth laminate on beam face, (B) spirally wrapped cellular cellulose acetate spanwise core bars, (C) convolutely wrapped vertical CCA core bars, which are inserted to interrupt the spanwise core units.



ASSEMBLY fixture for holding panel's upper and lower skin sandwiches and internal structure in place during oven cure. Laminated closure gusset for leading edge outer nose joint will be applied in another curing operation.



PANEL ROOT END closeup shows pattern of honeycomb portion (A) of core sandwhich, where match-angle will be bolted for connecting panel to wing center section. Gusset (B) provides slot for holding beam.



BOTTOM SURFACE of access openings (which will be fitted with metal covers) and flap ribs clamped in place (right).

WINGTIP of impregnated glass-cloth laminate.

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ON THE *hi-shear* RIVETING PROCESS

For riveters, inspectors, structure and tooling designers, training supervisors and trade schools.

Key points of the HI-SHEAR process in the booklet and film are presented in a non-technical style and include:

- How and why HI-SHEARS are used.
- Hole preparation.
- Rivet installation and removal.
- Inspection and trouble shooting.
- Safety points.
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THE *hi-shear* RIVET TOOL CO.
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LOS ANGELES, CALIF.

Wright-Patterson AFB. Information is that performance has been satisfactory.

▶ **General Makeup**—The original AT-6C panel was a conventional skin-stringer type. The new plastic structure essentially is a sandwich-type shell embodying a low-density core material faced with thin, high-strength inner and outer skins of fibrous glass-reinforced laminates. Mainly, Owens-Corning Fiberglas cloth is reported to have been used for the skin laminates.

A few internal members plus the sandwich shell make up the completed plastic wing panel.

Here's the fabrication technique ECA employed to construct the glass-plastic panel:

First a mold was constructed for the skin shell. This was made of rolled aluminum sheet reinforced with aluminum formers on the outside. The formers were attached to a steel dolly to permit rolling the mold into the curing oven. Joints between the aluminum formers and the steel dolly allowed for differential expansion of the metals so there would be no distortion of the mold.

Bar stops were installed on the mold to delineate the wing panel boundaries. Auxiliary fixtures located the rib members and positions for wing beams. Other fixtures established molded-in support locations for the aileron control quadrant and the landing gear retracting strut.

This mold scheme was repeated to give separate forms for the upper and lower halves of both right- and left-hand wing panels.

Separate metal molds were constructed for the beam members—main, intermediate, flap, aileron and jackpad support beams—and for the panel skin reinforcement in the flap area. Reinforced-plastic molds were made for the wing tips. For the aileron shroud, a plaster mold was used.

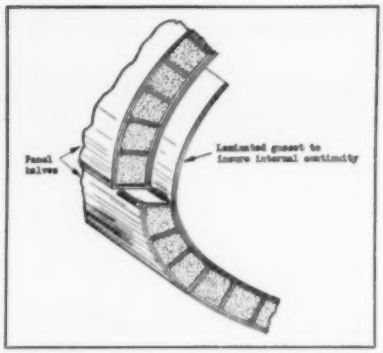
▶ **Skin Sandwich**—For the wing outer skin, glass-fabric cloth was impregnated with polyester resin and the cloth then cut to pattern. Lay-up in the mold was such that lamination thickness varied from 0.18 in. at the wing root end to .021 in. at the tip.

Cellular cellulose acetate (CCA) core bars for the sandwich were spirally wrapped with resin-impregnated glass cloth, then placed spanwise in the mold over the inner surface of the outer skin laminations.

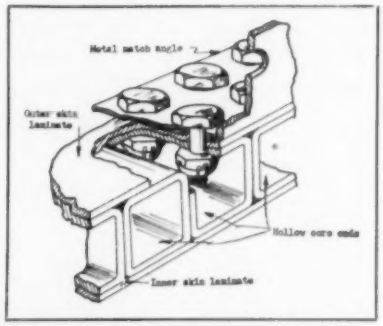
The CCA core bars varied from 0.525 in. thick at the root to 0.3 in. at the tip. Core bar width was about 1 in. The inner skin laminations were placed over the core bars to complete the basic sandwich structure.

During this stage of the layup process, provisions were made for inspection door openings in the panel's upper and lower surfaces.

Next, CCA rib formers convolutely wrapped with resin-impregnated glass cloth were installed at their respective stations. There are four of these formers, the outboard unit constituting the tip-attachment station.



HALVES of panel are joined at leading edge with laminated extension.



PLASTIC outer panel is connected to wing center section by match angle.

▶ **Gussets for Beams**—Slots (channels) for receiving the beam members were provided by placing wrapped, triangular CCA gusset strips on the inner skin on each side of the beam locations.

Proper width for the slot formed between gussets was insured by the temporary insertion of aluminum strips (cured in place with the half-panel, then removed after curing).

A vinyl blanket was placed over the half-panel assembly and sealed around the periphery with zinc-chromate paste. After the mold dolly was wheeled into the oven, tubes from a vacuum source were connected to the blanket. Thermocouples were installed on the mold at various places. Oven temperature was brought up to about 250F over a period of about three hours, then held at that temperature for about two hours. Pressure under the blanket was maintained at approximately 10 psi.

After the curing, the blanket was stripped, excess resin removed and edges trimmed in the cleanup process.

▶ **Beam Makeup**—Meanwhile, the beam members were being prepared in the same general manner as the skin sandwich, except that the spirally wrapped spanwise CAA core bars were interrupted at intervals with convolutely

wrapped vertical core bars. Thickness of the beam was maintained constant from root to tip. Laminations on the beam faces varied from 20 plies at the root to five plies at the tip.

The aileron shroud, flap and wing tip were made up entirely of glass-cloth laminate.

Curing these components was similar to the procedure used in curing the skin panels.

▶**Panel Assembly**—For matching the internal members to the upper and lower skin sandwiches, the upper panel was first placed on a final assembly fixture. Then the internal structure was fitted in place after all faying (contact) surfaces had been faced with a layer of resin-impregnated glass-cloth and an excess of resin.

The matching (lower) sandwich skin was placed over the opposite edges of the internal structure after all contact surfaces had been faced with the single layer of glass cloth and excess resin.

In this joining of skins to internal structure, provision was made for bonding together the inside skins of the upper and lower sections at the leading edge nose joint. This continuity connection was in the form of a laminated skin extension from one shell to the other.

▶**Assembly Curing**—The final assembly fixture's outside surface was fitted with chordwise formers conforming to the airfoil contour and incorporated reinforcement members along the beam lines.

Clamps on the formers supplied pressure to hold proper airfoil contour and insure close contact between panel skins and internal structure.

The fixture, carrying the complete assembly, was wheeled into the oven for panel-curing at 250-275F for approximately two hours. After cure, another glass-fabric lamination was placed over the leading edge to provide outer skin continuity over the nose joint. This lamination thins to a single thickness about six inches aft of the nose joint. Curing of this nose lamination was done in the oven under a vacuum blanket.

After this the flap ribs were located and clamped in place and bonded in the oven. The aileron shroud installation was effected in a similar manner.

▶**Root Connection**—A metal match-angle was used for attachment of the plastic panel to the metal center wing section.

To provide for this connection, the CCA cores at the root end of the sandwich skin initially had been cut off for a distance of about 3½ in., with metal inserts substituted for the cut ends. These metal plugs were convolutely wrapped with lamination of resin-impregnated glass cloth.

After the panel sections had been

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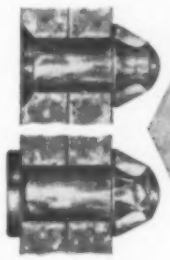

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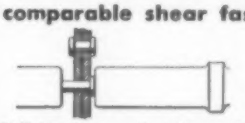

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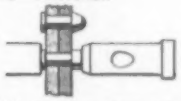
½" AD aluminum rivet driven with 4½-lb. gun and rivet set. Shear strength—518 lbs. Speed—17 rivets per minute.

5 SEC. TOOL CHANGE

Remove previous rivet set—insert 1-piece Hi-Shear Rivet set in same gun. Set change time—5 seconds.



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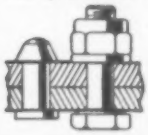
¼" Hi-Shear Rivet driven with same gun. Shear strength—3,681 lbs. Speed—17 rivets per minute.

LIGHTER than any comparable shear fastener!



A Hi-Shear Rivet weighs only one-*third* as much as an AN bolt-nut-washer combination having the same shear strength and grip.

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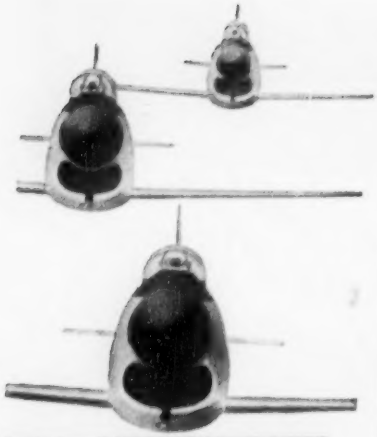

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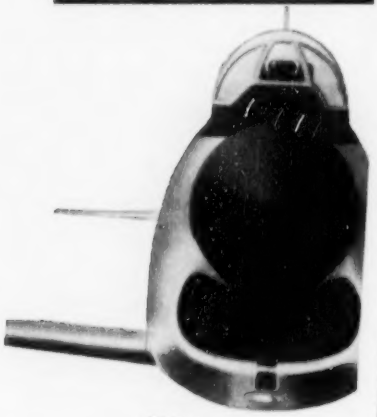

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LOS ANGELES INTERNATIONAL AIRPORT
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cured, the plugs were removed to give a laminated, rectangular honeycomb pattern at the wing root.

▶ **Adhesive and Bolts**—A layer of resin-impregnated cloth was used as an adhesive between the match-angle and the outer skin of the panel area beneath it. Clamps were used to hold the angle and skin in close contact. After curing, holes were drilled through the match angle and outer skin laminate to accommodate attaching bolts.

In this arrangement, both the angle-to-skin bond and the mechanical joint contribute to insure strength of the outer panel-to-center section attachment.

Riveted plate nuts around access openings in the plastic panel provided means for attachment of metal inspection-doors.

▶ **High Fnish**—The completed panels were given a finish paint treatment which, in conjunction with the smoothness of the plastic material, gave an extremely high-gloss surface to those components.

Wright-Patterson's Aerodynamics Section is said to have performed flight tests with the plastic-wing-equipped AT-6C, that showed an appreciable reduction in the minimum drag coefficient as compared with the original metal panel.

Navy Contracts

The following contracts were announced recently by the Navy's Aviation Supply Office, 700 Robbins Ave., Philadelphia 11.

N. S. T. Corp., 2642 S. 5th St., Philadelphia 48, box, electrical outlet, 2,703 each, $27,706.

Goodyear Tire & Rubber Co., Inc., 1144 E. Market St., Akron 1, brake assy. for TBM-3E aircraft, 175 each, $49,866; maintenance parts for brake assys., $38,970.

Breeze Corp., Inc., 41 South 6th St., Newark 7, N. J., lead assy., 5,669 each, $45,069.

Vapor Blast Mfg. Co., 3025 W. Atkinsons Ave., Milwaukee, decomposed rock grit, $26,077.

Briggs Bituminous Composition Co., 1349 E. Montgomery Ave., Philadelphia 25, bituminous emulsion coating, 37,000 gal., $53,140.

Chelsea Clock Co., 284 Everett Ave., Chelsea 50, Mass., clocks, $57,046.

Gubb Special Products, division of the E. Horton & Son Co., Windsor Locks, Conn., kits and spare parts, $31,957.

Delco Products Div., General Motors Corp., 329 E. First St., Dayton 1, damper assy., 267 each, $51,455.

I. T. E. Circuit Breaker Co., P. O. Box 98, Greensburg, Pa., parts for aviation armament, $34,340.

Cleveland Pneumatic Tool Co., 3781 E. 77th St., Cleveland 5, strut assys. for P2V-2, -3 aircraft, 10 each, $48,680.

Driaire Inc., 132 South Main St., South Norwalk, Conn., dehydrated plugs, $34,361.

Bendix Products Div., Bendix Aviation Corp., 401 Bendix Drive, South Bend 20, Ind., strut assy., 87 each, $116,997.

United Aircraft Corp., Pratt & Whitney Aircraft Div., East Hartford 8, Conn., screen assys., $49,043; shaft, couplings, $244,603; spare parts for support of P&W engines,

LITTLE GIANT

This prover for one of the forge giants in the Air Force heavy press program is a 1/16-scale working model of the 35,000-ton unit being built by E. W. Bliss Co. for operation at Kaiser Aluminum and Chemical Corp., Newark, Ohio. Model follows the full-scale make-up in every important detail, spans 53 in. from top to bottom to simulate the 70-ft reach of the projected machine. It will be used for laboratory analyses of stresses developed under various load conditions and is reported to have a working capacity of 137 tons. Model also will help work out proposed assembly for the 35,000-ton press. Inspecting the model are (left to right) Plant Manager R. Y. Moss, President H. U. Herrick, Sales Manager E. A. Erwin, and Special Engineering Chief E. V. Crane.

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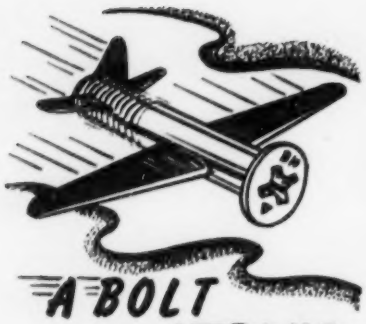

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$514,803; bearings for engines, 9,689 each, $32,652; engine spares, $268,402; maintenance parts for P&W engines, $775,022; maintenance and spare parts for P&W engines, $4,606,756; crankshaft assy., $1,522,176; spare engine parts, $850,442.

United Aircraft Corp., Hamilton Standard Div., Windsor Locks, Conn., maintenance parts for oil controls, $35,602; propeller spares, $83,092.

Norma-Hoffmann Bearings Corp., Stamford, Conn., bearings, 11,700 each, $25,389.

Moe Rakofsky Co., 1227 Rockaway Ave., Brooklyn 36, N. Y., armament handling equipment, 311 each, $28,969.

Western Coating Co., P. O. Box 227, Elyria, Ohio, compound, 76,000 lb., $38,163.

Garod Radio Corp., 70 Washington St., Brooklyn 1, N. Y., test set, 45 each, $70,962.

Reliance Manufacturing Co., 212 W. Monroe St., Chicago 6, parachute assy., 782 each, $106,352.

USAF Contracts

Following is a list of recent USAF contracts announced by the Air Materiel Command.

Admiral Corp., 3800 Cortland St., Chicago, Radiac meter, spare parts, data, 2,371 ea., $314,727.

Allen Business Machines, R. C., 678 Front Ave., N. W., Grand Rapids, indicator, 2,457 ea., 739 ea., 1,298 ea., $515,637.

Buick-Oldsmobile-Pontiac Div., General Motors Corp., Detroit, airplanes, $29,967,522.

Continental Aviation & Engineering Corp., 1500 Algonquin Ave., Detroit, modification of engines, 102 ea., 8 ea., $52,360.

De Luxe Laboratories, Inc., New York, preview prints, 1,600 reels, $50,000.

Eastman Kodak Co., 343 State St., Rochester, camera, 38 ea., spares, data, $31,635; cameras & maintenance parts, $74,546.

Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J., indicator, 1,044 ea., 33 ea., 102 ea., $199,349; 3,644 ea., $174,410; accelerometers, 830 ea., 2,777 ea., $33,233; bracket & bushing assy., 39,000 ea., stem-demand valve, 39,000 ea., screw set, 39,000 ea., $204,943; fuel indicator, 932 ea., 345 ea., spare parts, $64,676.

General Electric Co., 1 River Rd., Schenectady, N. Y., indicator, 566 ea., $58,874.

General Tire & Rubber Co., 1708 Englewood Ave., Akron, wheel assemblies, 334 ea., 16 ea., 73 ea., $38,229; 312, ea., 16 ea., 92 ea., $66,674.

Goodyear Tire & Rubber Co. Inc., 1144 E. Market St., Akron, wheel assys., 25 ea., 26 ea., brake assys., 25 ea., $64,736; wheel assys., 208 ea., 10 ea., 62 ea., $47,219.

Grimes Manufacturing Co., Urbana, Ohio, lighting fixture kits, 900 ea., $114,975.

Hughes Aircraft Co., Culver City, Calif., overhaul, repair modification, $558,335.

Kollsman Instrument Corp., 80-08 45th Ave., Elmhurst, N. Y., computer and transmitter, 41 ea., 25 ea., $44,019.

Mitchell Camera Corp., 666 W. Harvard Blvd., Glendale 4, Calif., camera & data, $209,319.

Morse Instr. Co., 21 Clinton St., Hudson, Ohio, processing unit, tabular list parts & literature & instr. book, maintenance parts, 200 ea., $67,598.

Pacific Mercury Television Mfg. Corp., 5955 Van Nuys Blvd., Van Nuys, Calif., receivers and mountings, 3,290 ea., $586,499.

Romec Div., Lear, Inc., Abbe Rd., Elyria, Ohio, pumps, 128 ea., 93 ea., spares, 80 ea., $37,761.

Seeger Refrigerator Co., 850 Arcade St., St. Paul, tank assy., 5,000 ea., $1,079,780.

Simmon Bros., Inc., 30-28 Starr Ave., Long Island City, electronic flash-head, 10 ea., enlarger, 114 ea., 7 ea., $85,385; camera, 100 ea., $40,805.

Sperry Gyroscope Co., Sperry Corp., Great Neck, L. I., automatic pilot, $70,530.

Western Electric Co., Inc., 195 Broadway, New York, carrier equipment, $204,500.

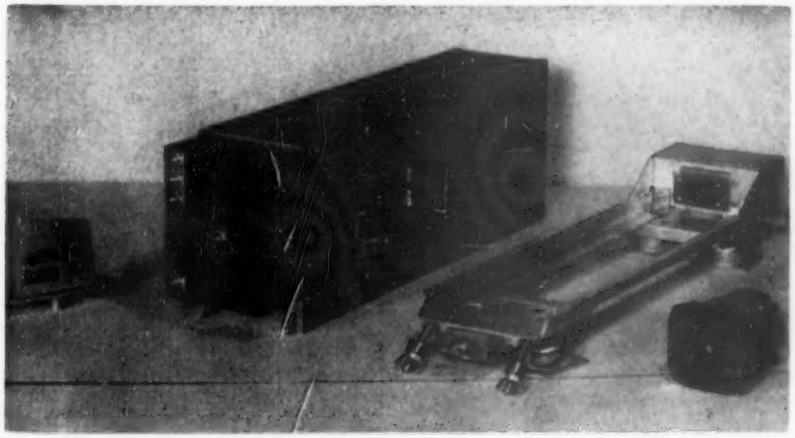
Westinghouse Electric Corp., 32 North Main St., Dayton, regulators, 441 ea., $103,877; generators, 240 ea., 228 ea., 24 ea., $607,369.

Bausch & Lomb Optical Co., 635 St. Paul St., Rochester, N. Y., camera set, 18 ea., spare parts, $47,893.

Bell & Howell Co., 7100 McCormick Rd., Chicago, camera, 33 ea., 45 ea., $104,315.

KAISER-FRAZER ASSEMBLES A C-123

Capacious, 75-ft.-long fuselage of a Chase-designed C-123 assault transport is put together on a Kaiser-Frazer production line at Willow Run, Mich. Components for this fuselage were fabricated by Chase Aircraft Co., at West Trenton, N. J., and shipped to Willow Run. Early K-F C-123 production will follow this plan while the company completes its own fabricating facilities. After K-F is set up, Chase will continue to furnish certain assemblies and may also make complete C-123s at West Trenton. In the background may be seen some Kaiser-Frazer-built Fairchild C-119F Packets being phased out at Willow Run to make way for C-123B production.



PAA DME INVESTIGATION covers the Hazeltine Model 1800 (left) and the Bendix NA-5. Range indicator of Bendix system is at right.

Pan American Finds New Use for DME

Pilots can fly simple, 'orbiting' approaches and report more accurate ETAs by using the equipment.

By George L. Christian

Pan American World Airways' evaluation of two competitive makes of distance measuring equipment has shown them both to be "amazingly accurate," according to Capt. C. N. Warren, chief check pilot of PAA's Atlantic Div. Flight tests have been going on for more than a year in a company DC-3. Now the company plans to evaluate reliability of the two makes in a couple of DC-6Bs in regular worldwide service, making PAA the first international operator to install DME.

The equipment that comes out ahead in the reliability investigation will probably go into the carrier's fleet of 40 DC-6Bs. The Bs, 18 of which are already in service, are being delivered by Douglas Aircraft with wiring and space provisions for DME.

With DME, an airborne interrogator unit tells the pilot how far the plane is from a particular ground station transponder, up to the equipment's maximum range of 200 nautical miles. It is expected that use of DME will mean more accurate navigation, fewer ground navigation aids, better air traffic control at airports during IFR conditions, and more accurate estimated-time-of-arrival reports.

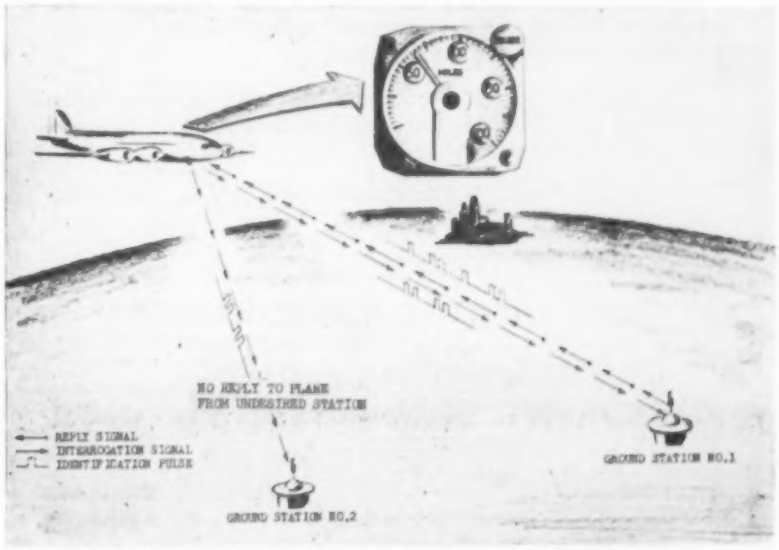
▶ **Two Makers**—Pan American's DME studies started in 1945. Tests in the last year have been on three sets, one from Federal Telecommunication Laboratories, Inc., Nutley, N. J. (an associate of International Telephone & Telegraph Co.); and two made by Hazeltine Corp., Little Neck, L. I., N. Y.

Hazeltine's two models are the 1800, designed for commercial airline use, and the 1810, a so-called "poor man's DME," that could make it possible for corporate and private planes to land during instrument flight (IFR) weather at airports that lack instrument landing system facilities but are within VOR-DME range. The 1800, also called the Bendix NA-5, is marketed by Bendix Radio Communications Div., Bendix Aviation Corp., Baltimore, Md.

▶ **CAA Backing**—The Civil Aeronautics Administration has ordered 450 transponder sets from Hazeltine, of which 371 have been delivered, at the rate of eight a week. Entire order will be completed this year.

Hazeltine transponders can be interrogated by 50 to 100 aircraft simultaneously, depending on the type of airborne interrogation equipment used. If overloaded, the transponders automatically reject interrogation from the weakest signals. These come from the aircraft farthest away, and therefore in the least immediate need of information.

CAA recently completed all ground installations for DME in the territory covered by Mohawk Airlines. CAA gave



BENDIX RANGE INDICATOR shows distance of plane from ground station.

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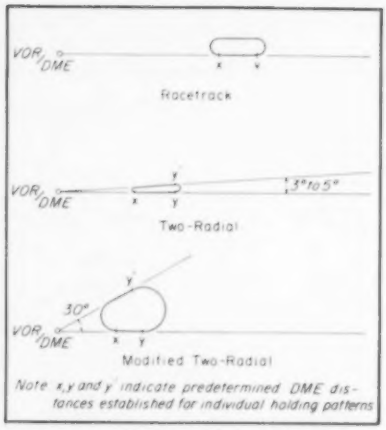

HOLDING PATTERNS with DME.

the New York carrier sufficient Hazeltine interrogators (Model 1810 or DIB) for a fleetwide installation and test of the equipment.

Federal Telecommunication Labs has 13 ground transponder sets in operation on the New York-Chicago run. They can be interrogated by up to 50 aircraft simultaneously.

► **Terminal Twist**—PAA has turned up a new twist for DME. The equipment, originally thought of as primarily an "en route" facility, now appears to be extremely useful at terminal areas for accurate, easy-to-fly holding patterns and for instrument landings in conjunction with ILS. This added utility can go far in justifying the original cost and maintenance of the equipment.

PAA's Capt. Warren lists these as advantages which can be derived through using DME at terminal areas:

• **Better ETAs.** DME allows the pilot to determine his ground speed quickly and simply and file more accurate estimated times of arrival. This was clearly demonstrated in a PanAm DC-3 test flight recently witnessed by this reporter.

The plane was on a heading to MacArthur Field, Sayville, L. I. As the chronometer sweep hand passed zero seconds, the DME dial told us we were exactly seven miles from the field. As the hand swept past zero seconds a minute later, DME told us we were only 4.6 miles from the field. In a matter of seconds we were able to calculate our ground speed—144 mph.

So ETAs may be calculated with an ease and precision heretofore unknown in this country. Accuracy of establishing ETAs by DME is pointed up by the fact that in over 15 flights conducted by the CAA where ETAs were established some 30 min. flying time from destination, average error was about one-quarter of a minute. Pilots can forget about computers, wind triangles, etc., since this method gives actual ground speed.

• **No marker beacons.** The cost of

Accuracy of Orbiting Maneuver

Test No.	1	2	3	4	5	6*	7
Radius	20 mi.	10 mi.	10 mi.	15 mi.	7 mi.	8 mi.	15 mi.
Degrees of Orbit	DME Readings						
00	19.9	10.0	10.0	14.5	7.2	8.0	14.7
10	19.9	10.0	10.0	15.0	6.9	8.0	14.9
20	20.0	10.0	10.3	15.5	7.0	8.0	——
30	19.85	10.0	10.0	15.3	7.3	7.9	15.3
40	19.9	10.0	09.4	——	6.6	8.0	14.5
50	19.8	10.0	10.0	15.0**	7.0	8.0	——
60	20.2	10.0	10.0	——	7.9	8.2	——
70	19.9	10.0	10.0	——	——	8.2	——
80	19.85	10.0	10.0	——	——	8.0	——
90	19.95	10.0	——	——	——	8.0	——
100	20.0	10.0	——	——	——	8.0	——
110	19.9	10.0	——	——	——	8.0	——
120	19.9	10.0	——	——	——	8.0	——
130	19.9	10.0	——	——	——	8.2	——
140	20.05	10.0	——	——	——	8.2	——
150	20.6	10.0	——	——	——	7.9	——
160	20.0	10.0	——	——	——	8.3	——
170	20.1	10.0	——	——	——	8.7	——
180	19.8	10.0	——	——	——	——	——

* *Test No. 6 was conducted while climbing from 4,000 to 10,000 feet msl.*

** *This reading was taken at 55 deg. of orbit.*

Accuracy of ETAs

Test No.*	Approximate flying time from fix at time estimate computed (minutes)	No. of changes in IAS	Min. IAS used (mph.)	Max. IAS used (mph.)	Difference between ETA and time over fix (minutes)
2	34 min.	6	110	160	.5
4	16	0	140	140	.7
5	20	7	125	155	.0
7	30	3	115	155	.2
12	16	0	147	152	.2
16	85	3	144	148	.5

* *Each test was flown by a different crew.*

marker beacons and the attendant problems of buying land to install the equipment and supplying power for sets can be avoided when DME is installed. It tells the pilot how far the airport is with an accuracy "equal to looking out of the cockpit," PAA finds. Bendix's Model NA-5 interrogator is designed for an accuracy of ½ nautical mile or 3%, whichever is greater. This means that at a distance of 30 miles, the set's design accuracy is ½ mile.

Two significant terminal facility innovations and improvements made possible by DME are "orbiting," a completely new procedure, and better, more accurately controlled holding patterns. The latter have the additional advantage of being easier to fly than customary patterns from the pilots' point of view.

► **Orbiting**—This new approach maneuver, made possible by DME, enables a pilot to fly a circular course as

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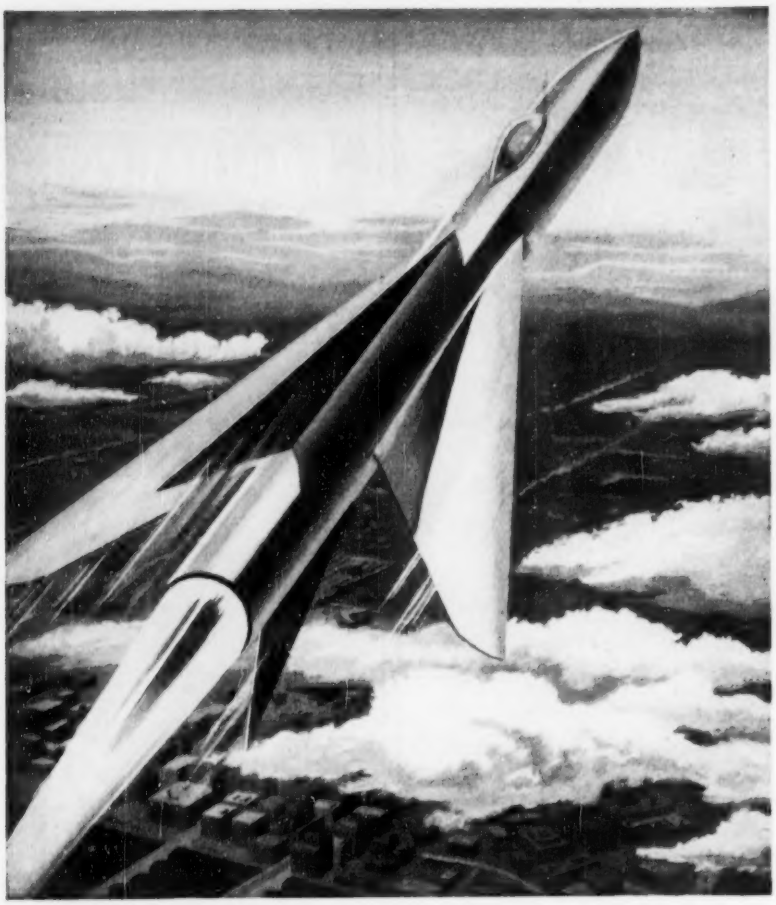

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accurately as a straightaway VOR radial. (An omnirange radial is flown by setting a preselected heading into the instrument, then keeping the vertical needle of the instrument landing system cross-pointer indicator centered in exactly the same manner as flying the localizer beam on an ILS approach).

Pilots who have flown orbiting procedures report that it is "very flyable." The approach seems safe and practical to a ceiling minimum of 500 ft. and 1-mile visibility. Accuracy of orbiting is indicated in the accompanying table, which shows that the maximum deviation during seven orbiting tests with radii from the VOR-DME station varying from 7 to 20 miles was 0.8 miles, minimum was zero miles; maximum average deviation was 0.355 miles and minimum average deviation was zero miles.

Here is an example of advantage of orbiting: At Cleveland, the VOR-DME station is west and slightly south of the metropolitan area, while Cuyahoga Airport is east and north of the city, 23 nautical miles distant. So planes flying from station to airport (on a 76-deg. heading) created a noise nuisance and possibly hazardous approaches were made directly over the city.

With DME, a plane can fly over the station and assume a heading of 64 deg. This takes the flight north of Cleveland, out over the lake. Altitude is 2,000 ft. When DME shows the pilot that he has proceeded 22 miles from the stations, he executes a standard-rate turn to the right and starts letting down. When plane has made approximately a 90-deg. turn, pilot discontinues flying a fixed heading; instead, he maintains a circular course which keeps him at a constant 23 miles from the station. He is flying an arc of a circle centered at the station. In the meantime, the VOR omni-bearing selector has been preset to 76 deg.

Result is that when the VOR receiver's vertical needle is centered, plane is directly over the airport.

It is this orbiting procedure that would allow corporate and private aircraft, equipped with the Hazeltine 1810 DME set, to make instrument landings at hundreds of fields heretofore usable only during visual flight (VFR) conditions because they had no ILS or ground controlled approach facilities.

► **Better Holding Procedures**—The PAA flight illustrated clearly how VOR-DME equipment allows pilots to fly holding procedures with greater precision and ease than the conventional variety using range intersections and homing facilities. Here is what PAA found:

- **Patterns can be flown** on basis of actual distance covered rather than on a time basis of one or two minutes.
- **Airspace will be used** more economi-

cally, because aircraft can hold anywhere within the range of the VOR-DME station instead of being limited to range intersections and homing facilities.

• **Tighter, more precise pattern** can be flown since pilot has continuous bearing and distance information available.

▶ **Holding Patterns**—At least three types of holding patterns can be flown.

• **Race track pattern.** Here an aircraft can fly on a VOR radial for a predetermined distance monitored on DME. Then a procedure 180-deg. turn is made and a parallel reverse course followed for the same distance as the inbound segment. Another 180 is made, and so on, until aircraft is cleared to next position or to land.

• **Two-radial procedure.** This slightly modified race track procedure uses two different VOR radials for the sides of the pattern, producing a slightly egg-shaped circuit. It is somewhat more precise than the former pattern. It proved to be easy to fly at reasonable distances from the station using radials with a directional difference of 3 to 5 deg.

• **Modified two-radial procedure.** Using radials 30 deg. apart, this pattern is reasonably easy to fly, but appears to have limited air traffic control application, according to a CAA report.

The report says: "Satisfactory results were obtained by all the crews performing the various holding patterns. The radar observers reported 'tight and exact' patterns, even though some of the tests were flown with 40-knot cross winds."

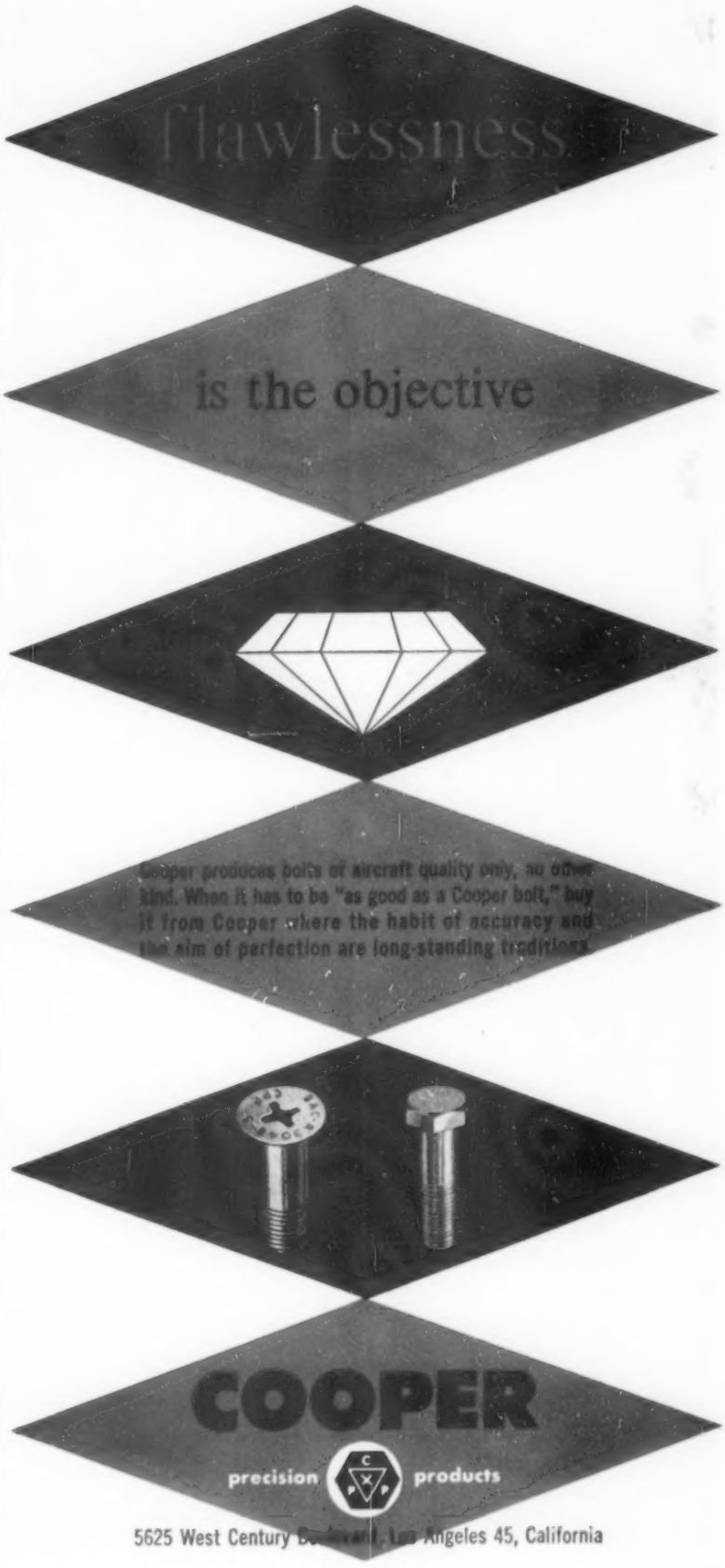
▶ **Must for Jets**—PAA officials have well in focus the many new problems that will arise when the 500-mph. de Havilland Comet 3s are put into operation. DME, they feel, will be a must. British Overseas Airways Corp., first commercial jet operator, appears to concur in this opinion.

Warren cited these advantages of DME as an en route facility that will be valuable to jets:

• **More accurate navigation.** Since DME permits an aircraft to be navigated a little more accurately than is otherwise possible, en route times are slightly reduced. In jet operation, the saving in fuel consumed is especially important.

• **Fewer navigational facilities.** Since CAA intends to install over 400 DME stations in this country alone, it is quite possible that many radio range stations could be eliminated.

• **Timesaver.** An axiom among pilots is: "Never let down until you know where you are." Result is that when flying over mountainous terrain under IFR conditions or at night, pilots may stay at en route altitude until directly over destination. Then a time-consuming letdown is made. Such procedure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However, with DME supplying the pilot with continuous and accurate readings of his distance from destination, he can safely let down step by step as the terrain below him recedes, saving time, fuel and money.

▶**This is DME**—To give the pilot a continuous indication of his distance from a VOR-DME station, the airborne interrogator transmits a series of radio frequency pulses. Received by the ground station transponder, the pulses cause an automatic transmission of a series of reply signals.

When received by the interrogator, that unit derives distance information from the time difference between interrogation and reply. This information, the slant range between aircraft and ground station, is instantaneously and continuously fed into a standard 3-in. aircraft instrument, the needle of which shows the plane's progress toward or away from the ground station.

In the Bendix equipment, the interrogator's quarter-wave, stub antenna is small, less than 5 in. high, and may be mounted in any convenient location on the aircraft.

A direct-reading frequency selector in the cockpit permits the selection of 100 DME frequency channels. Usually one Bendix-type MN-81 control panel operates both the VOR receiver and the DME interrogator, since all DME stations are sited at VOR locations. Tuning the VOR to the desired station automatically tunes the DME interrogator to the correct channel. Lighting for the control panel is Bendix' Da-Nite system which gives numerals a white light in daytime and red light at night.

▶**Nomenclature & Specifications**—Hazeltine's Model 1800, the Bendix NA-5, is called the Model DID Airborne Interrogator by CAA. List price, including antenna is $7,000.

Model 1810 weighs 31.25 lb., compared to Model 1810's 22.75 lb. The 1810 consists of two packages: a power supply measuring approximately 8x6½x 6½ in., and the interrogator, whose dimensions are about 12¼x6x6½ in. CAA designation is Model DIB. Price will be about 40% less than DID.

Pan American engineers make this comparison between the Federal airborne DME set (called DIA) and the Bendix NA-5: The Federal unit is mounted on a one ATR chassis, the Bendix on a ½ ATR. The Federal uses some 60 tubes, the Bendix 27; so maintenance would presumably be simpler on the Bendix.

Pilots preferred the Federal Veeder Root instrument presentation of distance information to the Bendix dial

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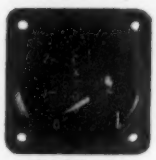
0 to +1000°C Exhaust Temp.



MODEL 49B

MODEL 49B, 1⅞" case to AND 10403
—50 to +300°C Cylinder Temp. . . .
0 to +1000°C Exhaust Temp.

MODEL 76B

MODEL 76B dual, 2¼" case to AND 10401
—50 to +300°C Cylinder Temp. (AN 5536-2A or T2A)
—50 to 300°C Bearing Temp. . . .
0 to +1000°C Exhaust Temp.

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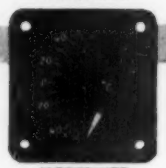
Accurate ratiometers, these **LEWIS** indicators are remarkably free of voltage error, have nearly linear scales (not crowded at the ends) and are magnetically shielded. A few typical ranges are given below. Not shown is Model 46B, 2¾" single.



MODEL 47B

MODEL 47B, 1⅞" case to AND 10403
—70 to +150°C AN 5790-6 or AN 5790T6
0 to +125°C Oil Temp. . . .
—50 to +50°C Air Temp.

MODEL 77B

MODEL 77B dual, 2¼" case to AND 10403
—70 to +150°C AN 5795-6 or AN 5795T6
+30 to +230°F Oil Temp. . . .
+100 to +300°C Cylinder Temp.

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pointer system. They said the Veeder counter was easier to interpret and could be read to finer tolerances. Bendix officials say there would be no problem to equip the NA-5 with a Veeder counter.

If a power or other type failure occurs in the Federal unit, it warns the pilot that something is wrong by "searching" rapidly. Searching means that the Veeder counter rotates at a considerably faster rate than when ticking off mileage in normal operation. The Hazeltine instrument has a centerally mounted red-and-white checkered flag which shows in a window to warn that something is wrong. The needle on this instrument also searches for failures.

Bendix Radio Communications Division is now installing an NA-5 set in a company Twin-Beech. After preliminary flights, the plane will be used to give a series of demonstration flights at several major aviation centers throughout the U. S.

Federal spokesmen told AVIATION WEEK that its airborne equipment, called "interrogator-responsor," is being tested by United, American, Trans World, Pan American, Capital, Eastern and Northwest Airlines.

Pan American officials credit Charles Horne, former CAA administrator, with actively pushing DME since its inception.

AF to Test New Jet-Resistant Runway

Service tests of flight aprons and taxiways constructed of coal tar-synthetic rubber concrete will be made this summer at several U. S. Air Force jet bases.

Present asphaltic concrete aprons and taxiways have proved inadequate because of the damaging effect of jet aircraft fuel. In normal ground operation and servicing of jet aircraft, spillage of kerosene-type fuel collects in puddles on the paving and does not evaporate quickly.

USAF has found that the fuel settles into the top wearing course, dissolves the asphalt and leaves crushed stone exposed. The stone often is blown away by blasts from jet engines.

▶ **First Tests**—Air Force engineers point out that aprons and taxiways built of portland cement are not affected by jet fuel.

Construction is to begin about May 15 on the first complete experimental tar-rubber concrete taxiway at Davis-Monthan AFB, Tucson, Ariz.

In laboratory and operational tests conducted thus far, coal tar-synthetic rubber concrete has proved most satisfactory, engineers report. Tests were made of tar concrete, asphalt mixed

with natural rubber and the tar-rubber compound.

Davis-Monthan AFB, now under reconstruction in line with Air Force's current expansion program, has been selected for test of the experimental concrete in a hot, dry climate. Five other bases have been selected as representative of various other climatic regions of the U. S. Parking aprons will be constructed of tar-rubber concrete at Hanscom AFB, Mass., Laredo AFB, Tex., McChord AFB, Wash., Smoky Hill AFB, Kans., and Walker AFB, N. M.

Each of the tar-rubber installations will be in single aprons or taxiways of from 20,000 to 30,000 square yards of concrete.

F-94C fighter interceptors to be based at Davis-Monthan will test the new pavement under routine jet operating conditions. The new apron at the field should be in use by Aug. 15, engineers say. It will be composed of a 2½-inch binder course of asphaltic concrete with a top wearing surface of 1½-inches of coal tar-synthetic rubber concrete.

Prior to the proposed Davis-Monthan experiment, AF engineers conducted patch tests on a thousand-foot strip of runway in the moderately warm climate of Hunter AFB, Ga., in March 1952. Extensive tests followed last summer at the Air Force testing laboratory at Vicksburg, Miss. Further patch tests will be conducted at Presque Isle AFB, Me.

Meanwhile, parking aprons, taxiways, wash rack areas where cleaning detergents injure asphaltic concrete, and a thousand-foot stretch at each end of base runways are being built of portland cement at all permanent Air Force installations where those areas could formerly be paved with asphaltic concrete.

Pinball Machines Help B-47 Testing

Pinball machine parts are incorporated in an ingenious device developed by W. H. Tygart of the Georgia Division of Lockheed Aircraft Corp. to check the wiring of B-47 Stratojets.

Tygart, electronic functional test specialist, took the relays from a pinball machine and built the checker, which is portable, simple, and easy to keep in working order. It has cut the wire inspection time for one circuit in the B-47 electronic system from an eight-hour job for two men to 30 minutes for one man. The device costs $65 in materials and the time of three men for a week, against $6,000 for a standard tester.

The standard device is manual while the Lockheed instrument is fully auto-

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Transmitters	AY201-1	26V, 400~, 1 ph.	225	1.25	25+j115	11.8	9.5	3.5	15
	AY201-4	26V, 400~, 1 ph.	100	0.45	45+j225	11.8	16.0	6.7	20
Receivers	AY201-2	26V, 400~, 1 ph.	100	0.45	45+j225	11.8	16.0	6.7	45
Control Transformers	AY201-3	From Trans. Autosyn	Dependent Upon Circuit Design				42.0	10.8	15
	AY201-5	From Trans. Autosyn	Dependent Upon Circuit Design				250.0	63.0	15
Resolvers	AY221-3	26V, 400~, 1 ph.	60	0.35	108+j425	11.8	53.0	12.5	20
	AY241-5	1V, 30~, 1 ph.	3.7	—	240+j130	0.34	239.0	180.0	40
Differentials	AY231-3	From Trans. Autosyn	Dependent Upon Circuit Design				14.0	10.8	20

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Receivers	AY503-2	26V, 400~, 1 ph.	235	2.2	45+j100	11.8	23.0	10.5	90
Control Transformers	AY503-3	From Trans. Autosyn	Dependent Upon Circuit Design				170.0	45.0	24
	AY503-5	From Trans. Autosyn	Dependent Upon Circuit Design				550.0	188.0	30
Resolvers	AY523-3	26V, 400~, 1 ph.	45	0.5	290+j490	11.8	210.0	42.0	30
	AY543-5	26V, 400~, 1 ph.	9	0.1	900+j2200	11.8	560.0	165.0	30
Differentials	AY533-3	From Trans. Autosyn	Dependent Upon Circuit Design				45.0	93.0	30

For detailed information, write to Dept. H.

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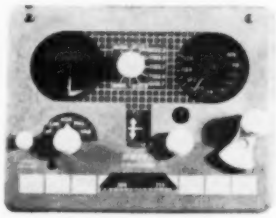

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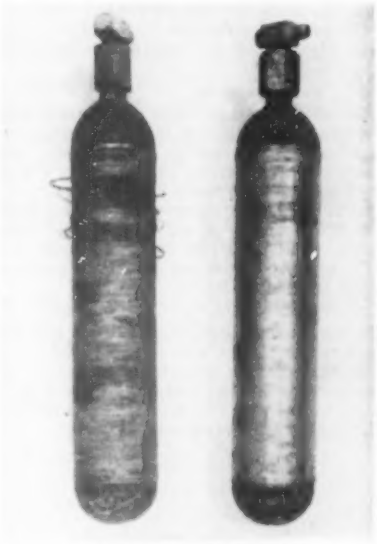
After the device is connected to a 50-wire cable, it requires only five seconds to check the cable for continuity and four seconds per wire to check for shorts.

It is applicable to any electrical system using multiple wire cables, and can be used for telephone and communication systems. The device also checks out its own circuits for faults. It uses 28-volt d.c. current and requires but .003 amp. for testing.



HOLE IN BOTTLE

What happens to a metal bottle containing liquid or gas under pressure when hit by a .50-cal. slug is shown at left, above. Walter Kidde & Co., maker of such bottles, wraps them with piano wire to prevent the cylinders from shattering when hit in military aircraft. One of every 200 bottles is picked off Kidde's production line and put to the test on the company's firing range at its Belleville, N. J., plant. Should cylinder prove to be defective, five more of the same heat are tested. If any of these are faulty, the whole batch is returned for reprocessing.

to the

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with an interest
or experience in
RADAR *or*
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Hughes Research and Development Laboratories, one of the nation's large electronic organizations, are now creating a number of new openings in an important phase of operations.

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OUR COMPANY
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are for men who will serve as technical advisors to the companies and government agencies purchasing Hughes equipment.

YOU WILL BE TRAINED
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you may (1) remain with the Laboratories in Southern California in an instruction or administrative capacity, (2) become the Hughes representative at a company where our equipment is being installed, or (3) be the Hughes representative at a military base in this country—or overseas (single men only). Adequate traveling allowances are given, and married men keep their families with them at all times.

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RESEARCH AND DEVELOPMENT LABORATORIES
Scientific and Engineering Staff
Culver City, Los Angeles County, California

Assurance is required that the relocation of the applicant will not cause the disruption of an urgent military project.

NEW AVIATION PRODUCTS

Pressure Operates Sealed Potentiometer

Trans-Sonics, Inc.'s new pressure-operated potentiometer is the only one of its type with the winding and mechanism sealed in a vacuum, the company says.

Possibly the most important use of the unit, called the Baroresister, is in adjusting servo loop gain as a function of altitude. It also serves as a transducer in telemetering and recording systems. Vacuum sealing of the pressure-reacting potentiometer provides a zero reference pressure unaffected by temperature changes, the company says.

The unit meets ambient temperature and vibration requirements of MIL E 5400. Strong spring action on the potentiometer wiper is said to assure electrical contact with the winding at accelerations up to 30G in any direction.

As it is fully enclosed, the potentiometer can be used in liquid and gas systems. Another use is in computers for determining Mach number. The potentiometer wiper is moved by a hydraulic bellows a distance of 0.25 in. across the 300 wires of the winding. According to the company, the bellows spring constant is low compared to that of the linear restoring spring so that excellent linearity and low hysteresis are achieved. Accuracy of the unit is listed as 2% of full scale.

Trans-Sonics, Inc., Bedford Airport, Bedford, Mass.

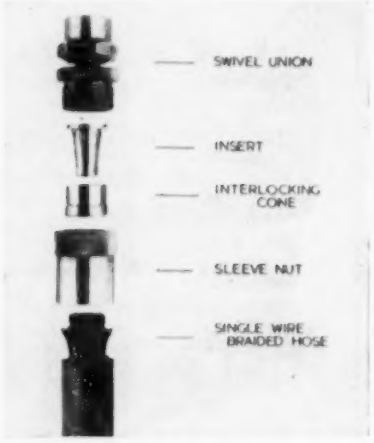
Pressure Warner

A device that flashes a red warning light the instant oil pressure drops below the danger point is being marketed by Van Dusen Aircraft Supplies.

Developed by Art Thompson of Meriden Aircraft Co., the unit consists of the light and a low-pressure switch that is installed by means of a tee connection immediately behind the oil pressure gage. The switch operates on 4-6 psi. It can be installed in less than hour, Van Dusen says, and has CAA approval.

The warning unit also can be used to remind the pilot to turn off his master switch before leaving the plane, or to indicate proper functioning of stall warning, landing light motor or turn-and-bank circuits.

Van Dusen Aircraft Supplies, Teterboro Air Terminal, Teterboro, N. J.



British Flex Hose

Flexible hose with detachable, swivel-type hand fittings is being produced for high pressure (to 5,000 psi.) and high temperature service in jet engines by Bowden, Ltd., Great Britain.

The firm says the couplings on this hose are the only ones so far developed in which the reinforcing wires of the hose are interlocked with the fitting. However, the detachable feature of these couplings is not exclusive with Bowden. Detachable end fittings have been supplied for some time now with aircraft hose produced by Aeroquip Corp. (AVIATION WEEK Dec. 22, 1952, p. 54).

Bowdenflex hose is produced in single- and double-wire braided types with a Neoprene outer cover for flame resistance. Internally it is lined with polysar plastic for gas and liquid service. The detachable fittings can be installed anywhere and readily permit inspection of hose ends for condition.

To install, a section of the Neoprene cover is stripped from the end to bare

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Reserve Power—for the extra-tough job.
Powerful, Continuous-Duty Motors—built in PET's own factory. Dynamically Balanced Armatures—for freedom from vibration.

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PET Superduty Drills are available in 54 distinct models and 3 capacities: ¼", ⅜" and ½". Your choice of pistol or saw-type grip. With such a broad line, you don't have to compromise on a drill that's "almost" right! You can choose *exactly* the drill you need for your job. The PET Superduty line includes drills meeting U. S. Government and military specifications.

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*Name*_____ *Title*_____

*Company*_____

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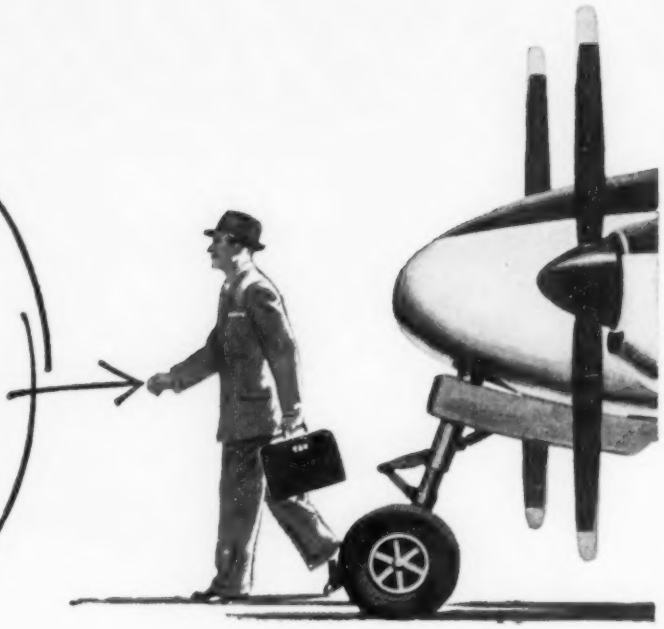
*City*_____ *State*_____

To the **PRIVATE** plane owner:



A spark plug, too, is known by the company it keeps!

You, as a private plane owner, can make a simple test to determine the best spark plug. Ask: "*Who uses them?*"

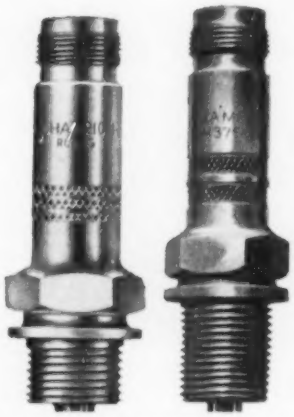
So far as Champion Aircraft Spark Plugs are concerned, the answer is:

—Every major domestic scheduled airline.

—A majority of overseas airlines.

—A very high percentage of our military aircraft.

—So many quality-conscious owners and pilots in private and corporate aviation, that Champion is the most popular aircraft spark plug on the market—year after year.



The RC26S and R37S-1 are the most widely used of Champion's many types of aircraft spark plugs.

It is this tremendous popularity, and the great production volume that it permits, that enable Champion to maintain extremely low prices on top quality spark plugs.

It is a safe conclusion that once you have flown with Champions you will never again be completely satisfied with any other spark plug.

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CHAMPION IS A PRIME SUPPLIER TO THE U. S. ARMED FORCES

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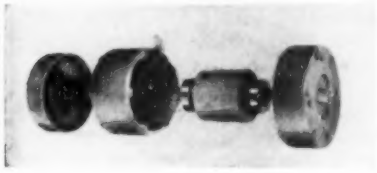
CHAMPION

SPARK PLUGS

the wire braid. A sleeve nut is slipped over the end of the hose and butts against the edge of the Neoprene cover. An interlocking cone fits inside the sleeve nut, over the wire braid. The hose braid is pressed against the inside of the cone by a tapered insert which is forced into the inner tube of the hose and expands the braid outward to lock with the cone. The whole assembly is secured in place when the swivel union is threaded into the sleeve.

Bowden has also announced establishment of a separate Flexible Pipe division to market the company's flexible pipe direct to customers. The firm claims to be the largest manufacturer of high pressure hose in Great Britain.

Flexible Pipe Division, Bowden, Ltd., Willesden Junction, London, N. W. 10.



Airborne Generator

A small induction a.c. generator developed by AiResearch promises to reduce weight and bring greater simplicity and reliability to aircraft and missile electrical power systems. The generator is already in mass production.

The company says the unit, a capacitor-excited type, is the smallest of its rating ever built.

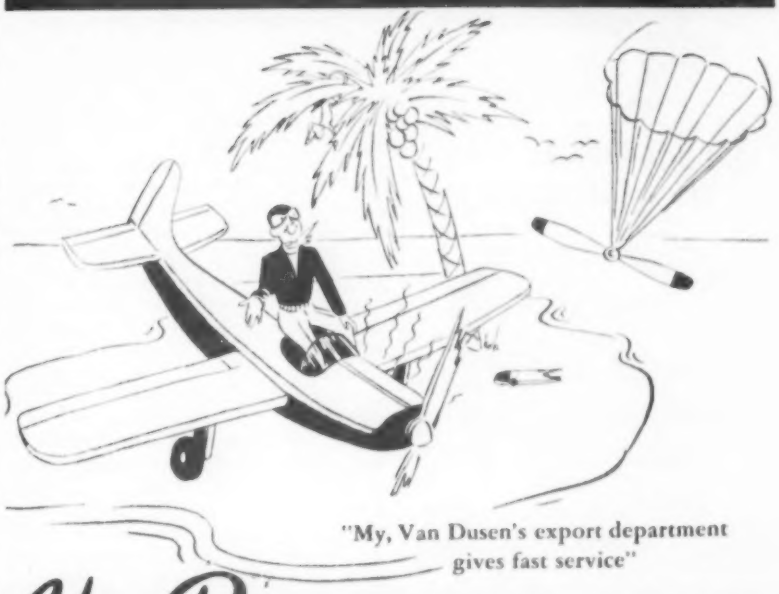
The new generator weighs only 4½ lb., has an 800-watt output and provides 115/200-v., 3-phase, 400-c. current. It is about half the size of an automobile generator.

The new power supply requires no voltage regulator, or external source of a.c. or d.c. voltage to shock-excite it into building up, AiResearch says. It is magnetized at the factory and no further external excitation is needed, except that provided during operation by a simple shunt-connected capacitor bank, the only auxiliary equipment.

The unit can also serve as a motor, making it especially valuable in some missile applications, the company points out. It can bring the entire missile power supply up to speed prior to launching—driving hydraulic pumps, air conditioning fans, energy storage flywheels and other accessories. It may be used to bring up to speed the turbine which will drive it after takeoff, providing a smooth transition, without transfer relays, from external to internal power supply.

Slip-ring and radio noise problems are avoided as there are no electrical connections to the rotor. Without brushes, the machine is adaptable to

Van Dusen DOODLES.....



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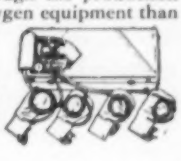
Modern engines and radio equipment are most efficient and economical at higher altitudes. But, most flying businessmen can't take full advantage of flying at most favorable altitudes because their aircraft lacks proper oxygen equipment.

Now, at low cost, the Scott AVIOX offers you the altitude breathing comfort and safety you need. This portable unit comes complete in a handsome leather carrying case, serving up to four persons.

This advanced design is the result of experience gained through the production of more portable oxygen equipment than any other company in the world.



For complete information about the AVIOX write SCOTT AVIATION, 275 Erie St., Lancaster, New York.

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high-altitude operation. The absence of slip-rings, rotating windings and voltage regulators also contributes to greater reliability, the firm notes.

Highspeed operation with low windage losses are obtained with a small, cage-type rotor. A high degree of excitation is obtained because it is dependent not so much on rotor size as on the number of excitation capacitors used, AiResearch says.

The design also provides inherent short-circuit protection. If the generator is shorted, so are the excitation capacitors. Recovery time after removal of a short is said to be 0.2 sec.

After a load change, output voltage changes smoothly to new steady state value within approximately six cycles, according to the firm. The thin-gage, high-quality steel used in the unit's stator laminations simplifies cooling problems.

The new generator can withstand 50G shocks and 40G accelerations, tests show.

It reportedly meets voltage unbalance requirements of MIL-G-6099 with a margin of 60% or better. Another model of the same design but of higher capacity weighs 29 lb. and has a 4-kilowatt output.

AiResearch Mfg. Co., 9851 Sepulveda Blvd., Los Angeles 45.

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Save the time of your own technical personnel. Use rapid AETCO SERVICE—America's finest facilities for performance testing of hydraulic system components, including:

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Double-end tube deburring and facing can be performed on twin end-finishing machine by one man. Automatic cycling frees his hands for loading and unloading.—Pines Engineering Co., Inc., 601 Walnut St., Aurora, Ill.

Extension rod-chuck accommodates standard drills for long-reach jobs, reducing need for brazing drill to rod or use of costly special length drills.—Beaver Tool Co., Box 298, Huntington, L. I., N. Y.

Twisted polyethylene rope doesn't sink and is unaffected by salt water and remains flexible at −70F; can be used for liferafts or other airline needs.—U. S. Plastic Rope, Inc., 2581 Spring St., Redwood City, Calif.

Simple deburring tool with manually rotating blade has been developed primarily for the aircraft industry for speedy smoothing of straight and circular edges in plastic and metal parts.—Creative Research, Inc., 9003 Wilshire Blvd., Beverly Hills, Calif.

O-ring grooves with 31/64- to 4⅞-in. diameters can be inspected faster and easier to close tolerances with new dial indicator with .0001-in. scale graduations; useful for checking out-of-round inside diameters, tapered and other openings.—Reliant Industries, 4947 Firestone Blvd., South Gate, Calif.

Rubber-covered hydraulic hose for pressures up to 5,000 psi. is reinforced with high tensile steel wire to give maximum flexibility and burst resistance under shock loads through temperatures of −40 to 250F.—Quaker Rubber Corp., 1932 Oliver Bldg., Pittsburgh 22, Pa.

Compact Teflon piston seal (BW Series S-11022) for hydraulic system components can be used where small amounts of leakage are permissible. Seal is responsive to bore irregularities, has little shift during pressure reversal and is designed to keep friction at a minimum. Consisting of two identical Kelon-T (Teflon) rings and metallic expander ring, seal accommodates dimensional changes caused by heat and pressure.—W. S. Shamban & Co., 11617 W. Jefferson Blvd., Culver City, Calif.

Triple-duty Circuitracer tester has been developed for locating grounds, opens or shorts in live and dead circuits. It traces virtually all types of circuits for continuity and presence of d.c. or a.c. voltage.—Delta Electrical Specialty Co., 1456 E. Walnut St., Pasadena, Calif.

FINANCIAL

Aircraft Interim Earnings

Three Months Ended Mar. 31*

Company	Gross Sales 1953	Gross Sales 1952	Net Income 1953	Net Income 1952	Net Income Per Common Share 1953	Net Income Per Common Share 1952
	(000 omitted)					
Beech (1)	$48,151	$39,920	$765	$651	$1.28	$1.09
Bell	35,006	24,274	867	368	.98	.42
Boeing	196,634	105,532	3,468	1,904	2.14	1.17
Consolidated Vultee (2)	96,584	86,561	1,761	1,458	.74	.61
Curtiss-Wright	96,762	67,621	2,446	1,766	.28	.18
Douglas (2)	231,654	81,491	4,390	1,997	3.66	1.66
Fairchild	39,117	21,040	894	547	.39	.24
Lockheed	158,000	89,000	3,500	1,058	1.39	.42
Martin	29,718	29,952	1,754	(D)670	.82	(D).59
North American	149,858	68,297	2,650	1,690	.77	.49
McDonnell	36,383	20,375	887	375	1.29	.55
Northrop (3)	42,163	42,592	432	431	.67	.68
Republic	97,567	66,423	1,902	1,357	1.72	1.35
United	202,895	144,755	5,900	3,745	1.75	1.07

NOTES: * Except the following: (1) Six months ended Mar. 31; (2) quarter ended Feb. 28; (3) quarter ended Jan. 31. (D) Deficit.

Aircraft Earnings Continue Climb

But short-term reports, such as those analyzed here, indicate trends rather than final results.

Sales and earnings for the aircraft industry are running substantially ahead of a year ago, with prevailing trends indicating that reported sales and earnings for 1953 will probably establish new peaks for the postwar period.

The accompanying AVIATION WEEK compilation of interim quarterly results shows how aircraft builders did.

► **Trends, Not Totals**—The results are by no means exact or conclusive, particularly when interim periods contain more estimate elements than are usually found in annual accounts. The contracting nature of the business, as repeatedly pointed out here, covers work projects extending over a period of years, introducing a number of accounting determinations that are not fully known for some time.

Nevertheless, a trend of results is clearly discernible in current reports. Of course, the usual qualifications concerning the impact of excess profits taxation and renegotiation also surround the reports.

► **EPT Adjustment**—Most companies continue to report earnings subject to the full impost of excess profits taxation. It is becoming increasingly questionable that this tax will lapse on June 30. If it does, current earnings (where full EPT provisions have been made) are obviously understated.

The full measure of subsequent adjustments "restoring" that portion of earnings previously written down by EPT will depend, in varying degrees, as to whether the company involved is on a calendar or fiscal-year basis. A company reporting on a calendar-year basis will be subject to a 30% rate, while those with a non-calendar fiscal year will be affected proportionately less (AVIATION WEEK May 18, p. 56). Retained earnings will, of course, be determined as final and conclusive only when the price redetermination and renegotiation processes are concluded.

Bell has revealed that if EPT expires, its net earnings for the first quarter will be increased by more than $70,000 or eight cents a share. On the other hand, Convair has already assumed the demise of EPT, making no provision for this tax. An additional tax liability of $93,000 will accrue if this impost does not lapse.

► **Sales Soar**—The accompanying table reveals that, with the exception of only Martin and Northrop, sales are up sharply for the 1953 first quarter as

RUGGED
RELIABLE
MINIATURE
Gyros

Above: two axis gyro
Below: rate gyro

American Gyro Corporation miniature gyros are reliable, rugged, hermetically sealed instruments with sufficient accuracy and sensitivity to satisfy most missile and aircraft requirements.

Designed for maximum performance with a minimum of accessory equipment, these gyros operate without heating or temperature control over the entire AN temperature range. Full flotation construction assures reliable operation under extreme acceleration and vibration conditions. Self-governed gyro motors eliminate close voltage and frequency control of the motor power supply.

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"He never was much for letter-writing when he was in college. But he must know how anxious Mother and I are . . . now that he's off in Korea. Haven't heard from him in six weeks. Of course, they say 'no news is good news' . . . but I wonder. Maybe he can't write . . . because . . . maybe he's in a hospital somewhere. And maybe he needs blood. I don't know . . . but I'm not taking any chances. That's why *I'm* giving blood."

★ ★ ★

Yes, all kinds of people give blood —for all kinds of reasons. But whatever *your* reason, this you can be sure of: Whether your blood goes to a combat area, a local hospital, or for Civil Defense needs— this priceless, painless gift will some day save an American life!

Give Blood Now

CALL YOUR RED CROSS TODAY!

NATIONAL BLOOD PROGRAM

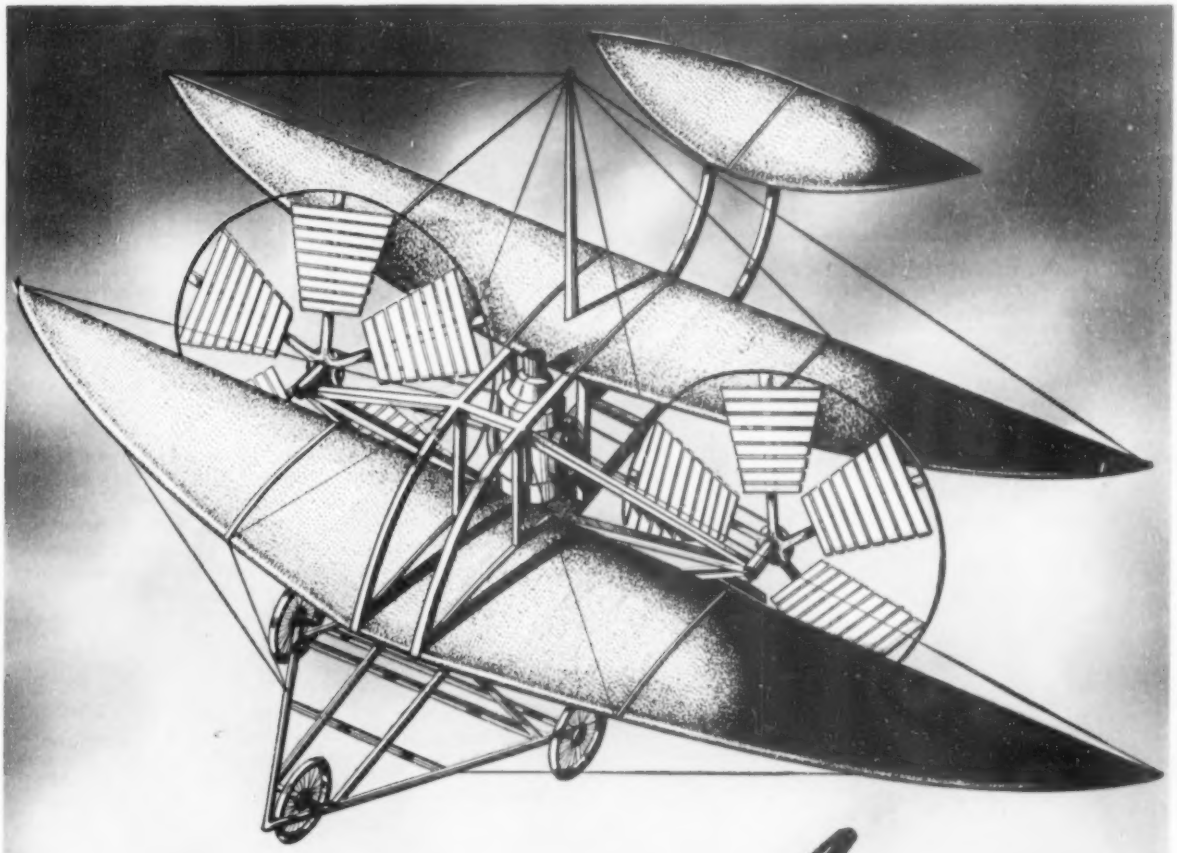
Business Executives!

✓Check These Questions!

If you can answer "yes" to most of them, you—and your company—are doing a needed job for the National Blood Program.

- ☐ Have you given your employees time off to make blood donations?
- ☐ Has your company given any recognition to donors?
- ☐ Do you have a Blood Donor Honor Roll in your company?
- ☐ Have you arranged to have a Bloodmobile make regular visits?
- ☐ Has your management endorsed the local Blood Donor Program?
- ☐ Have you informed employees of your company's plan of cooperation?
- ☐ Was information given through Plant Bulletin or House Magazine?
- ☐ Have you conducted a Donor Pledge Campaign in your company?
- ☐ Have you set up a list of volunteers so that efficient plans can be made for scheduling donors?

Remember, as long as a *single* pint of blood may mean the difference between life and death for *any* American . . . the need for blood is *urgent!*



...out of this came Aviation

...a precision industry

To serve this great industry a manufacturer must maintain the best and most modern equipment available, operate it with skilled craftsmen, and use every existing method of tightening specifications and cutting production costs. Indiana Gear is such a manufacturer—a company of craftsmen producing fine quality transmissions and actuators for industry.

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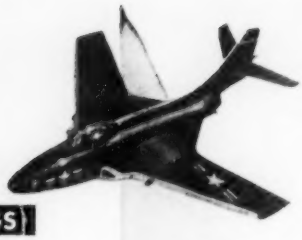

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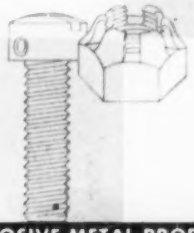
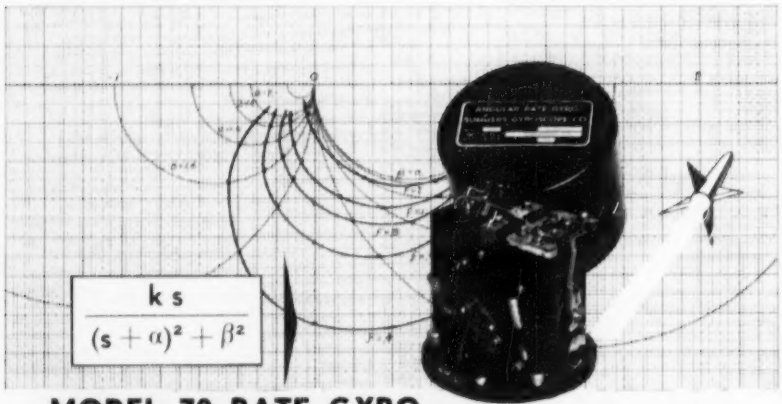
AVIATION EQUIPMENT manufacturers count on Anti-Corrosive for fast, dependable service on all types of *precision* stainless steel fastenings. They know that our IN STOCK inventory of more than 8,000 items and sizes is the largest, most complete, in the industry. In addition, our production capacity is geared to produce large or small quantities of stainless fastenings, of every size and description, faster and more economically.

Write for Catalog 53B today.



ANTI-CORROSIVE METAL PRODUCTS CO., INC.

Castleton-on-Hudson
New York



MODEL 70 RATE GYRO . . .
FOR MEASUREMENTS IN PITCH-ROLL-YAW

Another example of Summers precision engineering, Model 70 is now in production for use in missiles and aircraft

Characteristics:
Single or dual output Potentiometers up to 10 watt rating . . .
AC or Governed Rotor DC operation . . .
Compensated for Gimbal deflection errors . . .
Adjustable limit stops . . .
Designed for better than 1 per cent accuracy . . .
Model 70's Natural Frequency (cps) approximates the square root of Range (deg/sec) times 1.1

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2328 BROADWAY, SANTA MONICA, CALIF.

compared with the 1952 like period. Without exception, reported earnings are improved, in most cases by wide margins.

Martin, not being subject to any taxes, showed the most startling earnings contrast. While sales for the company's first quarter remained virtually unchanged at around $29.7 million, net income amounted to $1,754,000 for the 1953 first quarter, compared to a deficit of $670,000 for the like 1952 period.

Douglas reported the widest jumps in sales and earnings for the first quarter. But a large element of this increase is due to a special accounting treatment.

The company reveals total sales of more than $231.6 million for the three months ended Feb. 28, 1953, up some 185% over the $81.5 million of the same 1952 period. Reported net earnings are revealed at $4,389,787 for the current quarter, more than twice the amount shown for the comparable period last year. Current earnings may be improved further if EPT is killed, as current tax provisions of $1,211,000 would be restored to net income.

Sales for the current quarter were accelerated through a change in the form of one of Douglas' larger contracts, resulting in addition of $43,810,990 to sales for the current quarter. Presumably, earnings benefited accordingly.

In the absence of further data, it appears that the company has now elected to show higher sales and earnings during the earlier phases of its military contract work rather than wait for completion of these commitments.

This policy may be difficult to understand, as from a tax viewpoint the company could be better off to defer income for another year or so. Moreover, with stretchouts and cutbacks indicated in the aircraft procurement program, there is always the possibility that sales and earnings may be anticipated too soon.

The explanation for this change designed to show more immediate higher earnings may be found in the options on 60,000 shares granted Douglas officials in 1951, now fully effective.

The Douglas change appears to be in the same pattern as that adopted by Convair in 1950 when it altered its method of accounting for cost-plus-fixed fee contracts to record sales and profits on the basis of expenditures made and work performed. Prior to this change, sales and profits under such contracts were not taken into income until the time of delivery of the completed products. For Convair, this change meant increasing its 1950 earnings by $2.3 million.

Changes of this nature further reveal how tenuous reported results are for interim quarterly periods or even as much as 12 months. It is always desirable to view results over a series of years for proper perspective.—**Selig Altschul**

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First Quarter Airline Earnings

	1953	1952
	(000 omitted)	
American		
Opr. revenue	$44,505	$39,303
Net opr. income	3,961	2,278
Net profit	1,888	985
Braniff (Domestic)**		
Opr. revenue	7,088	6,808
Net opr. income	(—431)	37
Net profit	*	465
Braniff (International)**		
Opr. revenue	2,224	2,049
Net opr. income	(—284)	(—375)
Net profit	*	(—426)
Capital		
Opr. revenue	9,569	7,786
Net opr. income	(—194)	(—1,198)
Net profit	(—243)	(—1,082)
Delta-C&S (Domestic)**		
Opr. revenue	11,324	10,639
Net opr. income	1,406	1,473
Net profit	599	532
Delta-C&S (International)**		
Opr. revenue	1,095	1,223
Net opr. income	105	351
Net profit	50	165
Colonial (Domestic)		
Opr. revenue	1,435	1,093
Net opr. income	1	(—183)
Net profit	5	(—195)
Colonial (International)		
Opr. revenue	409	273
Net opr. income	10	(—63)
Net profit	10	(—64)
Continental		
Opr. revenue	2,491	2,342
Net opr. income	36	96
Net profit	683	37
Eastern		
Opr. revenue	39,672	29,512
Net opr. income	7,580	4,055
Net profit	2,826	1,546
Flying Tiger		
Opr. revenue	1,710	1,004
Net opr. income	57	(—310)
Net profit	215	304
National		
Opr. revenue	11,063	8,753
Net opr. income	3,114	2,064
Net profit	1,814	1,323
Northeast		
Opr. revenue	$1,357	$1,201
Net opr. income	(—303)	(—455)
Net profit	(—301)	(—451)
Northwest (Domestic)		
Opr. revenue	8,181	7,027
Net opr. income	(—1,463)	(—1,553)
Net profit	(—1,327)	(—1,564)
Northwest (International)		
Opr. revenue	4,002	3,578
Net opr. income	(—128)	(—723)
Net profit	(—106)	(—780)
Panagra		
Opr. revenue	4,496	3,862
Net opr. income	720	184
Net profit	948	116
Pan American (Consolidated)		
Opr. revenue	43,824	41,440
Net opr. income	(—1,558)	(—1,476)
Net profit	(—66)	(—532)
Riddle		
Opr. revenue	594	455
Net opr. income	32	33
Net profit	22	32
Slick		
Opr. revenue	2,432	2,086
Net opr. income	(—10)	24
Net profit	461	15
TWA (Domestic)		
Opr. revenue	29,035	22,452
Net opr. income	580	(—13)
Net profit	531	(—150)
TWA (International)		
Opr. revenue	10,531	10,295
Net opr. income	(—1,704)	(—283)
Net profit	(—1,858)	(—403)
United		
Opr. revenue	36,137	30,797
Net opr. income	1,099	2,167
Net profit	341	653
Western		
Opr. revenue	4,976	3,138
Net opr. income	173	333
Net profit	60	117

Source: Carriers' uniform Form 41, Schedule B reports to CAB.
*Braniff's 1953 first-quarter net profit reported only on consolidated foreign and domestic basis. It is (—$291,000).
**Braniff-Mid-Continent and Delta-C&S figures consolidated in both 1953 and 1952 for comparative purposes.

Trunk Airline Business Boom Continues

By Lee Moore

Airline business continues to boom this year, an AVIATION WEEK survey of major carriers' first-quarter reports to Civil Aeronautics Board shows.

Total revenues of the domestic trunk airlines gained 20% to more than $200 million the first quarter of this year, and net profits almost tripled the first-quarter showing of a year ago.

Major international routes lost approximately $1 million overall during first quarter of this year and last. Majority of the routes still are on temporary mail rates, and CAB decision on final rates may bring most of the internationals back into the black, both currently and retroactively, despite the usual seasonal slump of the first quarter.

All-cargo lines report an estimated $1 million more revenue for the first quarter of this year than in 1952, but non-operating profits continue to be marginal.

First quarter financial results are shown in the accompanying table. Retroactive changes not included in the reports are explained in the accompanying summary on each airline:

American revenues show normal growth for this prosperous period.

profit margin doubled. The carrier added seven new aircoach flights last month. American, TWA and United together now run 36 one-way transcontinental aircoaches daily.

Braniff blames a domestic net operating loss on lack of a subsidy mail rate to carry Mid-Continent, which Braniff bought last summer. To offset this loss, the carrier has asked CAB to increase its 53-cent domestic mail rate effective from last Nov. 10 forward.

Braniff International still is on a temporary mail rate. A temporary retroactive increase recently wiped out the $426,000 loss for the first quarter of 1952.

Capital shows a sharp revenue gain and sharper net improvement. This quarter's nominal, seasonal loss compares with loss of more than $1 million a year ago.

Colonial reports big revenue gains and small profits on both domestic and foreign (Bermuda) routes; substantial losses were reported the first quarter of 1952.

Continental reports a modest revenue gain and a seasonally low net operating income. Sale of equipment boosted net profit to more than $500,000.

Delta-C&S merged May 1. Their separate financial reports are consolidated in the accompanying table. Domestic revenues increased somewhat over last year's record. Profit is about the same. A final retroactive mail rate awarded may be subject to Supreme Court review (AVIATION WEEK May 18, p. 83). Circuit Court ruled it should be cut. CAB has re-opened Delta-C&S mail rates effective May 1, date of their merger.

Eastern shows great revenue and profit increases due to a record Florida season coincident with greatly expanded fleet capacity. EAL added 11 new one-way DC-4 coach flights this winter and did not cut back the schedules at the end of the season.

Flying Tiger reports nominal net operating income but realized a $215,000 net profit after sale of equipment. Sale of equipment during the first quarter of 1952 helped bring Tigers up from a $300,000 operating loss to a $300,000 net profit.

National made strong revenue and profit gains, winding up a record winter season. NAL and Eastern together offered 27 one-way coach flights per day between New York and Miami.

Northeast revenues gained. A final mail rate proposed by CAB last month will wipe out the losses shown for 1952 and 1953, substituting a modest profit (AVIATION WEEK May 25, p. 102).

Northwest first-quarter 1952 financial reports for both domestic and international recently were revised retroactively by CAB final mail-pay orders. Revised net loss comparison: domestic 1953 seasonal loss of $1,327,000, compared with nearly $2 million lost a year ago; international 1953 loss of $106,000, compared with a 1952 loss estimated at $300,000.

Panagra shows strong revenue and profit gain. A big part of the earnings came from a $600,000 profit reported for sale of equipment.

Pan American shows a $1.5-million loss for the first quarter of this year and last. But it is subject to radical change when CAB sets final mail rates for the dominant Latin America and Atlantic Divisions (AVIATION WEEK May 11, p. 99).

Riddle Aviation reports a substantial revenue gain but a nominal operating profit.

Slick Airways showed some revenue gain but a nominal operating loss. Net profit of $461,000 is due to profits on sale of equipment.

TWA Domestic system shows a big jump in revenue and a $500,000 profit.

TWA International lost approxi-

AVIATION EXECUTIVES MEET IN PUERTO RICO

Top aviation figures from all over the world met during the recent two-week International Air Transport Assn.'s sixth technical conference in San Juan, Puerto Rico. Highlight of the conference was a three-day helicopter symposium, summarized in Aviation Week (May 25, p. 95). In the top photo, the governor of Puerto Rico, Luis Munoz Marin (standing) addresses the delegates at the opening session. To his immediate right is Paul Goldsborough, TWA, vice chairman of the IATA Technical Committee. On the governor's left is Capt. J. C. Kelly-Rogers, Aer Lingus, chairman of the committee and J. A. Collings, TWA, chairman of the conference. In the second picture, Igor Sikorsky, famed copter designer and builder, speaks on rotary-wing developments. Among those present were Frank Piasecki of Piasecki Helicopter Corp., G. B. Clark, assistant vice president, Bell Aircraft Corp.; N. R. Hafner, helicopter designer, Bristol Aeroplane Co., Ltd.; Bernard L. Whelan, general manager of Sikorsky Aircraft Division; John Drummond, vice president, Canadian Pratt & Whitney Aircraft and Graham H. Aldrich, special projects director, Air Transport Assn.

mately $1.5 million but is subject to radical change when CAB decides the final trans-Atlantic mail rates.

United's profit dropped to $341,000, largely due to costs of integrating its new Convair 340 fleet. Revenues gained sharply.

Western reports only a nominal profit despite great revenue growth.

CAB Refuses Subsidy For Southwest 2-0-2s

Civil Aeronautics Board last week proposed a cut in Southwest Airways' subsidy to approximately $244,000 a year below the company's estimated need, retroactive from last Sept. 1.

CAB followed its recent precedent in the Pioneer Air Lines mail rate case, refusing to grant extra subsidy for operation of new transports, bigger and more expensive to operate than DC-3s.

▶ **Break-Even Rate**—The Board and Southwest forecast that the company may just about break even on the new mail rate with its planned mixed fleet of eight DC-3s and two Martin 2-0-2s.

CAB set the pay to cover cost plus $201,950 for income taxes and an 8% return on investment in DC-3s only. The rate is estimated to yield $1,042,919 mail pay per year. Southwest estimates its break-even need at $989,710 with the mixed fleet, slightly higher with more Martins. This compares with a CAB-Southwest estimate of $840,969 break-even need if the carrier uses DC-3s only.

The $1,042,919 annual mail pay proposed by the Board is based on a yield $72,800 non-subsidy compensation for mail service plus $970,119 subsidy.

▶ **Rate Formula**—As in the Pioneer case, CAB fell back on a set rate per plane-mile flown instead of the old sliding-scale formula. The rate is calculated on a fictitious all-DC-3 operation, and cannot be geared easily to load factor if Martins also are used.

It is forecast to yield an effective rate of 47.62 cents per plane-mile flown.

Southwest bought four Martin 2-0-2s late last year for about $285,000 each. The company started flying two of them on the Los Angeles-San Francisco run a month ago. Southwest is "currently contemplating the possibility" of adding more Martins on parts of its San Francisco-Medford route later.

▶ **Route Improvements**—CAB estimated its new mail rate for Southwest is $250,000 less than would have been required without recent route improvements on the airline's system.

The Board figures that its suspension of competitive United Air Lines service to four California towns yields an extra $200,000, and CAB suspension of Southwest service to three more towns saved an additional $50,000.

Sabena Plans New Copter Operations

Sabena Belgian Airlines plans to start scheduled helicopter passenger service Aug. 1, flying three Sikorsky S-55s on Belgium, France and Holland routes (AVIATION WEEK May 4, p. 11).

The carrier reports an agreement has been reached with the Netherlands government permitting inauguration of Brussels-Antwerp-Rotterdam service in two months. Simultaneous start of flights between Brussels and Lille, France, is planned.

Two other routes are planned later:

- **Brussels, Liege and Cologne, Germany.**
- **Brussels, Arlons, Luxemburg and Saarbrucken.**

SHORTLINES

▶ **Aero Club** of Washington placed an official marker on the polo field at Potomac Park May 15 to commemorate the takeoff point of the first scheduled U.S. airmail service inaugurated May 15, 1918.

▶ **Air India and Indian National Airways** have been testing air bumps and vertical gusts of wind occurring during the monsoon season between 12,000-14,000 ft. altitude for the Directorate General of Civil Aviation, according to a report released by the Transportation, Communications and Vehicles Division, Department of Commerce.

▶ **Airwork, Ltd.**, has been granted permission by the British Ministry of Civil Aviation to operate all-cargo service until May 1960 on routes from London to Frankfurt, Hamburg and Zurich.

▶ **BOAC's** Sir Miles Thomas reports British Comets flew 104,600,000 revenue passenger-miles and carried 27,700 revenue passengers during the first 12 months of operations.

▶ **Federal Republic of Germany's** air traffic has increased 200% over 1939 figures, when nearly every German city had its own airport. The republic now has nine airports in addition to those at Frankfurt, Hamburg, Duesseldorf, Munich and Stuttgart.

▶ **Flying Tiger Line** set a new record for March traffic with approximately $570,000 worth of material carried, a gain of 28% over March 1952.

▶ **Nicaragua's** government mail contract with TACA International Airlines S. A. of Oct. 1, 1952, has been ex-

COMMITTEE STUDIES AIRPORT PROBLEMS

To solve important community problems regarding operation of La Guardia and N. Y. International Airports, James A. Lundy, president of Borough of Queens, where the fields are located, recently called this gathering of top airline and public officials. Attending, seated left to right: Queens Borough works commissioner C. Parke Masterson, Lundy, Trans World Airlines president Ralph Damon and president-general manager of Eastern Air Lines E. V. Rickenbacker. Standing: Adm. C. E. Rosendahl, executive director of National Air Transport Coordinating Committee; American Airlines president C. R. Smith, Port of New York Authority aviation director Fred Glass and CAA regional administrator Ora Young. A five-man committee to study the various effects of airport operations on nearby residents, particularly noise problems, was formed to report directly to Lundy and airline industry leaders. This committee will include John Groves, New York operations manager of Air Transport Assn., J. D. Smith of Air Line Pilots Assn., Herbert Fisher of the Port of N. Y. Authority, Edward D. Marsh of CAA's Region 1 and Masterson of Queens.

tended to cover service to Argentina, Bolivia, Brazil, Ecuador, Panama, the Canal Zone and Peru.

► **Pan American World Airways** recent sale of more Cubana stock drops PAA share of the Cuban National Airline from 40% to 20%. Pan American's original cost of the 40% equity as of last Dec. 31 was reported at $420,000. . . . Firm flew 31,866 passengers, 19,797 of them refugees, out of Berlin during April, 4,297 more than the airline carried in March. Refugees were flown to camps near Hanover, Frankfurt and Hamburg in a 'round-the-clock airlift.

► **Sabena Belgian Airlines** is operating three first-class flights weekly and six weekly tourist-class flights, largest number in the carrier's history, between Belgium and the U.S. Sabena has 552 seats available weekly on its overseas service, 75% more than its seat capacity last summer.

► **Transport Air Group,** association of airfreight operators, scheduled a board meeting for June 1 to discuss expansion of TAG's technical activities, especially in reference to the Curtiss C-46 improvement program.

► **United Air Lines** has named its new Convair-Liner executive plane the "Mainliner O'Connor" after UAL stewardess in charge of special flights, Mary O'Connor, who has more than 4,500,000 mi. logged.

CAB ORDERS

Pan American World Airways granted year's extension of permit to fly nonstop from Havana, Cuba, to Tegucigalpa, Honduras, provided flights do not go further south. May 19, order No. E7394.

Tacoma Chamber of Commerce granted permission to intervene in trans-Pacific and West Coast-Hawaii route renewal cases; Long Beach chamber and city and county of Honolulu in the West Coast-Hawaii case. May 19. E7393.

Trans World Airlines given amended certificate permitting local Las Vegas-Los Angeles service in accordance with CAB Mar. 23 decision granting route to TWA and United Air Lines. May 18. E7392.

New York-Balboa through service proceeding (U. S.-South America interchange) re-opened following President Eisenhower's return of the case May 14 for more evidence on grounds that a considerable time had elapsed since hearing in 1951. May 18. E7391.

Interline agreements of United, Southwest and other airlines approved. May 18. E7390.

Cargo air service application for certificate dismissed on request of carrier. May 18. E7389.

Seaboard & Western Airlines granted exemption for four roundtrip passenger flights New York-Hamburg June 20-Aug. 15 by arrangement with city of Husum, Germany. May 15. E7388.

Aviation Corp. of Seattle denied exemption to fly 24 trips a month Seattle-Alaska in peak summer season on grounds that certificated carriers have promised to meet all needs for service. May 15. E7387.

Southern Airways granted permission to start serving Moultrie, Ga., June 1. May 15. E7386.

Flying Tiger-Slick Airways merger case: petitions by Minneapolis-St. Paul Metropolitan Airports Commission to intervene denied. May 15. E7384.

CAA complaint against John F. Caballero for certificating as airworthy a plane with wing fabric allegedly having tensile strength less than 46 lb. psi., dismissed on grounds CAA check was July 20, 1952, whereas Caballero certificated it one month previous. The Board says CAA has not established adequate "probative evidence" of violation of Civil Air Regulations. May 15. S567.

Christensen Air Service, Alaska, granted final non-subsidiary mail pay of $1,247 for operation Mar. 25-July 6, 1952 Seward-Anchorage. May 14. E7383.

Bonanza Air Lines petition to re-open and increase final subsidy mail rate order of Sept. 25, 1952, dismissed unless company amends petition to include "detailed economic justification" within 10 days. May 14. E7382.

Northern Consolidated Airlines complaint against reduced fares filed by Pacific Northern dismissed. May 14. E7381.

Seaboard & Western denied permission to fly a group of refugees from Munich, Germany, to New York May 19, on grounds that TWA also is willing to provide the service; CAB policy refuses a passenger charter business to international nonskeds as long as a certificated airline is willing to take the job. May 14. E7380.

Delta Air Lines suspension of service to Longview/Kilgore/Gladewater Airport, Tex., proposed by CAB so long as Trans-Texas Airways serves it. Investigation ordered. May 14. E7379.

Trans-Texas certificate expiration between Ft. Stockton and San Angelo, Tex.—with Pioneer Air Lines certificate amendment to take over such service—put under investigation. May 14. E7378.

American and Eastern Air Lines practice of charging first-class fares on parts of coach flights put under investigation as possibly unreasonable or discriminatory. May 14. E7377.

General passenger fare investigation dismissed at airlines' request and a staff survey substituted for hearings (AVIATION WEEK May 25, p. 96). May 14. E7376.

Flying Tiger-Slick merger case motions of consolidation of other issues by American and UAL denied on grounds they would unduly expand scope and delay disposition of the case. May 13. E7375.

North Central Airlines certificate amendment application of Grand Forks, N. D., for service to that city denied. May 13. E7374.

American Airlines certificate amendment proposed by San Antonio and AA to lift restriction on Dallas-Ft. Worth-San Antonio service denied. May 13. E7373.

Andrew Flying Service and Cockett Airlines, Hawaiian air taxi operators, exemptions to give regular service on routes not served by certificated carriers renewed for another year. May 12. E 7372.

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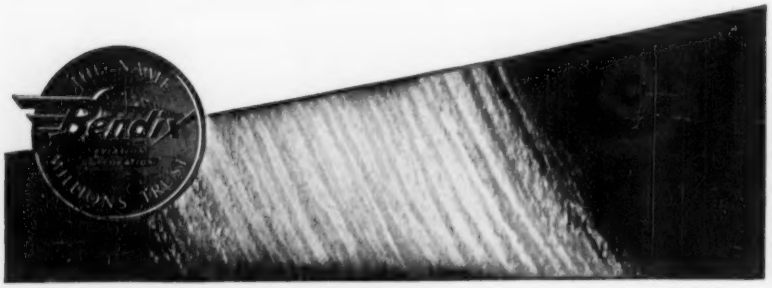

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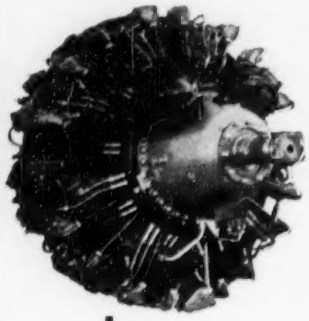

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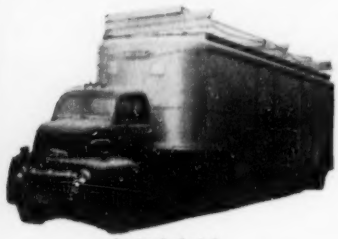

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Operation Overload

Despite the popular saying, a pilot's fancy in the springtime usually turns to thoughts of overloaded takeoffs—and not so lightly either. Anxiety rises on hot days with something like the square of the temperature when takeoff performance becomes just plain soggy.

There is, of course, an elaborate set of regulations, known as Transport Category, which advocates adequate safety margins. Pilots have learned, however, that paper proposals and actual conditions are often miles apart; this mileage is greatly increased by the coefficient of summer expansion. Throughout T Category great stress is placed on "average." That is, all maneuvers and conditions of flight are supposed to be safe when average pilot technique is used. This is a noble purpose and undoubtedly would work well if the average transport would maintain T Category specifications. Unfortunately average planes not only may fail to meet these specs, but CAB doesn't even require test flights to prove that they do.

► **Deviations**—Perhaps we should start at the beginning. A new plane is certificated—and it is a new plane, with new full horsepower engines. Then the assembly line begins to roll and the customers take over. But they do not necessarily buy T Category airplanes. CAB says engines are acceptable which contain a 2% power deficiency, which in turn means a loss in takeoff performance.

Or the airline purchaser may decide to use different certificated engines and hang on some extra accessories. These changes may be made without a test flight. The net result may be a certificated airframe plus certificated powerplant which, when added up, does not equal T Category.

Perhaps even more important, this combination is now subjected to practical line operations and average pilot technique. Line operations include power deterioration, increased drag from dents, loosened cowls, etc., brakes and tires in various stages of wear, added equipment and many other things. It is no longer quite the same aircraft.

Average pilot technique includes fatigue, diversion of attention to numerous cockpit duties, weather problems, communications and, most important, little anticipation of power loss. Again quite different from prevailing conditions on the test flight.

► **Less Than Average**—Now, over the years gross weights have a habit of going up with each modification in engine performance, although rarely is there a load reduction to compensate for decreased performance.

For instance, there is a ship flying today which can be shown to be nearly 8,000 lb. overloaded for takeoff, yet it was originally certificated as meeting T category. It is little solace at this point to tell the pilot that the prototype once met the requirements. He knows that his chances on takeoff are now less than average.

Every six months, airline pilots are required to redemonstrate certain skills and be re-examined for physical fitness. This is a far cry from the airplane which didn't even have an exam in the first place and gets no periodic performance checks.

► **Up to Snuff**—It is not possible, of course, to run complete performance tests on every airplane every few months. Nevertheless, pilots expect that the planes they fly should be up to snuff. Several cures are possible, including the previously mentioned off-loading to make up for performance loss. Or CAB could require wider margins at licensing time to provide for eventual deterioration.

And there should be provisions for test flying powerplant changes as well as maintaining rated power. With such steps as these, the average pilot might have his average chance on the average takeoff.

AVIATION CALENDAR

June 5-July 5—20th International Aviation Display, sponsored by the Union Syndicale des Industries Aeronautiques, Bourget Airport, Paris.

June 7-12—Summer meeting of Society of Automotive Engineers, Ambassador and Ritz-Carlton Hotels, Atlantic City, N. J. Technical talks will include Arctic aircraft operation and trans-Polar shortcuts between U. S. and Europe.

June 9-11—Second International Aviation Trade Show, Hotel Statler, New York.

June 11-13—Fifth annual All-Women International Air Race, Welland, Ont., to New Smyrna Beach, Fla., sponsored by Ninety-Nines, Inc.

June 16—Seventh session of the assembly of the International Civil Aviation Organization, Brighton, England. Session is expected to last three to four weeks.

June 16-19—Spring technical meeting of the American Welding Society, Shamrock Hotel, Houston.

June 17-19—Mid-year meeting of Aviation Distributors and Manufacturers Assn., Chateau Lake Louise, Alberta, Canada.

June 19-21—Pennsylvania State Wing convention of the Air Force Assn., Hotel Roosevelt, Pittsburgh.

June 22-July 3—Special summer program presenting a formalized theory for analysis and synthesis of feedback control systems and classes July 6-17 in advanced strength of materials, Massachusetts Institute of Technology, Cambridge.

June 29-July 2—Semi-annual meeting, American Society of Mechanical Engineers, Hotel Statler, Los Angeles.

July 1-3—Annual meeting of University Aviation Assn., National College of Education, Evanston, Ill.

July 3-7—Seventh All-Women Transcontinental Air Race from Lawrence, Mass., to Long Beach, Calif.

July 4-5—Dedication of Coles County Air port, Mattoon, Ill.

July 9-12—Sixth International Aviation Exposition, Wayne County Airport, Detroit.

July 15-16—IAS Annual Summer Meeting, Honors Dinner, IAS Building, Los Angeles, Calif.

Aug. 2—Amarillo, Tex., Jaycee Air Fair, observance of 50th anniversary of powered flight, Tradewind Airport.

Aug. 2-8—Fourth annual congress, International Astronautical Federation, Zurich.

Aug. 19-21—Western Electronic Show and Convention, Civic Auditorium, San Francisco.

Aug. 19-24—Seventh International Model Plane Contest, sponsored by Plymouth Motor Corp., Selfridge AFB and Belle Isle, Detroit.

Aug. 25—Opening of the ninth legal committee meeting, International Civil Aviation Organization, Rio de Janeiro.

Sept. 5-7—National Aircraft Show and 50th anniversary of powered flight, Dayton (Ohio) Municipal Airport.

Sept. 7-17—Fourth International Aeronautical Conference, joint meeting of RAeS and IAS, London.

Sept. 21-25—Eighth National Instrument Exhibit, Instrument Society of America, Sherman Hotel, Chicago.

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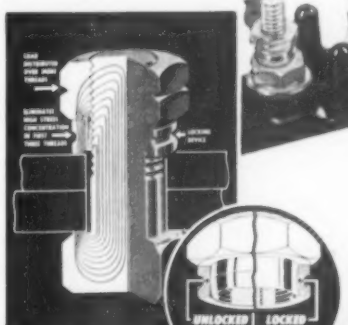

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EDITORIAL

Support Crash Injury Research

Washington budget-slashing and talk of getting more out of every federal dollar spent raises the possibility that some vital activities may be chopped off or crippled simply because their returns have not been sufficiently publicized or appreciated by top policy-making officials.

One little group which has pioneered successfully in the commendable objective of saving human life is the Crash Injury Research project of Cornell Medical College. Everyone should know more about its work.

There now is almost universal acceptance of the value of accident prevention. But the Crash Injury Research project has gone a significant step further—it works to reduce the toll of injuries and deaths in those accidents which do occur. Its accomplishments are impressive, and it has proved that greater achievements are attainable in the future if it can be allowed to continue its mission.

Crash Injury Research was established in 1942, under its present director, Hugh DeHaven, and operated until the end of the war with funds provided by the Office of Scientific Research & Development. During this period, members of the project worked directly with the Navy and Air Force to establish parallel crash-injury studies by military groups. More recently, annual support has come from the Office of Naval Research, the Air Force, Army, Navy and Civil Aeronautics Administration.

This project set up at Cornell Medical College the first acceleration-deceleration facilities for testing shoulder harness. It built the first dynamic testing apparatus for 40G seats. It developed an inertia lock for military shoulder harness. It arranged a forum for discussion of civil and military safety problems at five crash injury research conferences held at the National Academy of Sciences under the auspices of the National Research Council.

But even beyond these contributions, the project—working with other divisions of Cornell University through the Cornell Committee for Transportation Safety Research—has been directly responsible for a widespread stimulation of design and engineering thought which has led to a growing realization by engineers that safety in aviation must also include the protection from injury in crackups.

Using crash-injury findings from previous accidents, engineers have achieved a valuable increase of safety by devising structures and installations which reduce exposure to injury in survivable accidents.

CIR has worked extensively with civilian aircraft designers. However, its findings—that human structures and aircraft structures can tolerate the force of severe crashes—have directly complemented the excellent safety studies conducted by the Directorate of Flight Safety Research, the Aeromedical Laboratory, and the Office of the Surgeon General of the Air Force, as well as studies by the Flight Safety Division of the Office of the Chief of Naval Operations and the Navy's Bureau of Medicine and Surgery.

The design of crashworthiness into personal, agricultural and executive aircraft has automatically contributed to safety in "off the shelf" liaison and light transport aircraft now used by the Army, Navy and Air Force.

It has contributed to increased safety in large transport planes, as well. One notable example is the major redesign in forward-facing passenger seats, attachments, and safety belt installations which have been the direct result of observations on the dangers set up by steel seat backs in small planes.

The effectiveness of new design in forward-facing seats now is being studied by the project for comparison with accident-injury data on the safety of rearward-facing seats based on data from British civil and military experience as well as from other sources.

CIR's stimulation of research on problems of impact, energy absorption, crash force recorders, kinematic effects of the body on safety belts and measurement of force in controlled crashes, has contributed to an interchange of concepts, studies and findings which have served effectively in increasing the safety of military and civilian flight.

Although the engineering art of providing protection in accidents is still young, there is signal evidence of the effectiveness of CIR's project in recent extension of crash-injury studies developed in aviation to the automotive field where many of the measures now used to give more safety in aircraft accidents can be applied in passenger automobiles.

Despite CIR's humane, unique mission to save life for civilian as well as military personnel, and in ground vehicles as well as in aircraft, this project—like all government-supported research programs working under the "one-year edict"—lacks any assurance of funds for long term continuation.

A short-term policy for long-term, effective safety research is no more in accord with good business practices of government than short-term, spasmodic spurts and slumps in our vital military aircraft production program if our national welfare is to be promoted at maximum efficiency and effort.

Crash Injury Research Project merits the continued support of its federal sponsors whose foresight has already contributed to CIR's effective return in the saving of human life.

—Robert H. Wood

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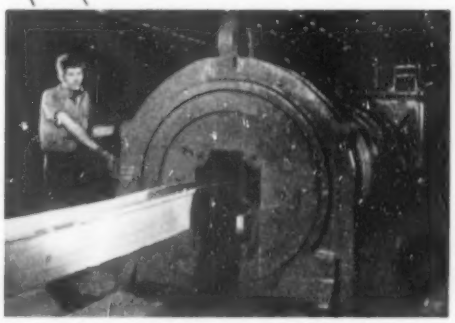

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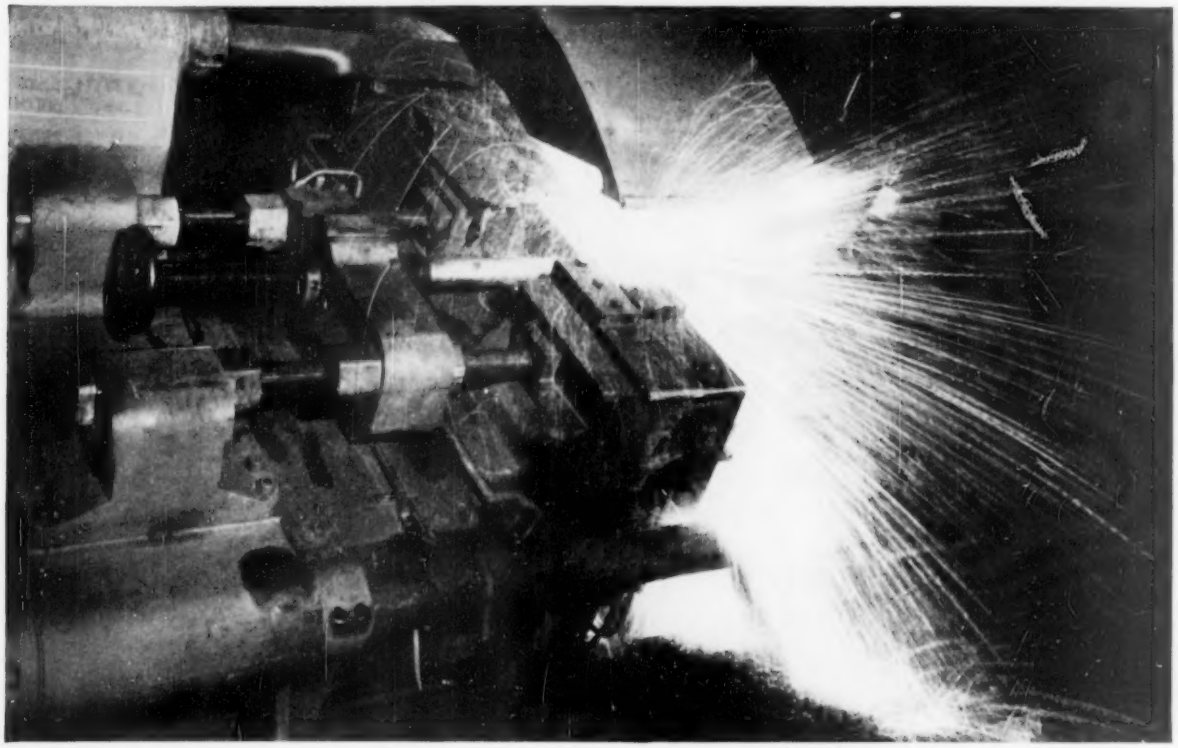

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Here's how we get more perfect welds

To join the separately forged turbine wheel and shaft of a jet engine into one integral part, this specially designed flash welding machine heats the joint electrically to fusing temperature. Then, under 120 tons' hydraulic pressure, the two parts are welded into a perfect unit.

This unique automatic welding process—the most uniform and economical method known—is applied by Allison engineers to get stronger, more perfect welds. It eliminates the air pockets, voids and slag common to manual welds. Not one of the thousands of welds made with this machine has failed in service.

Painstaking care in all stages of Allison engineering and production is one of the many reasons for the continuing improvement in the already superior performance of Allison jet engines.

Lowering J33 turbine wheel and shaft into special flash butt welding machine.

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World's most experienced designer and builder of aircraft turbine engines — J35 and J71 Axial, J33 Centrifugal Turbo-Jet engines, T38 and T40 Turbo-Prop engines